THE RELATIONSHIP BETWEEN TIME-ON-TASK IN COMPUTER-AIDED-INSTRUCTION AND THE PROGRESS OF DEVELOPMENTAL READING STUDENTS AT THE UNIVERSITY OF TEXAS AT BROWNSVILLE AND TEXAS SOUTHMOST COLLEGE

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This research sought to determine what relationship exists between time-on-task in computer-aided instruction (CAI) using Destinations courseware and progress in reading ability of developmental reading students as indicated by the reading portion of the Texas Academic Skills Program (TASP) test. Time-on-task is the time during which a student actively works on Destinations activities, as recorded by the software management system. TASP, an exam required of all students in Texas public colleges, assesses reading, math, and writing skills. The population was made up of 482 students who took the TASP exam before and after CAI and who used Destinations CAI for remediation of reading skills. Null hypotheses were explored using Pearson correlation and linear multiple regression. The findings for the null hypotheses were the following: H_{o1} - Correlation and linear regression correlation showed that time-on-task in Destinations CAI had no significant effect on the TASP scores of the population studied. H_{o2} - Correlation and linear regression correlation showed that females made significantly better gains on the TASP test from CAI than males. H_{o3} – Correlation and linear regression correlation showed that low-achiever students made no better gains on the TASP test from time-on-task in CAI than high-achiever students. Difference between the

two group’s gains was not statistically significant. H_{o4} - The regression equations predicted the gain in TASP reading scores for less than 1% of the population studied. Only the regression equations for male students and female students separately were statistically significant. The researcher recommends replication of this study each semester to determine the effectiveness of CAI. Regular and systematic evaluation using pretest and posttest data will provide benchmarks so that the value of changes in instructional methods can be measured. This method of research can help to clarify questions that should be answered through other research methods.

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INTRODUCTION

Background

The University of Texas at Brownsville (UTB) and Texas Southmost College (TSC) both serve a large portion of the Lower Rio Grande Valley in the southern tip of the state of Texas. These institutions are located on the same campus in Brownsville, Texas, two blocks from the Rio Grande River and the Mexican border and 15 miles from the Gulf of Mexico.

Texas Southmost College was founded in 1926 by the Brownsville Independent School District to serve as a community college, the second community college in the state of Texas. It had grown to over 6,000 students when in 1992 it was combined in a unique partnership with the University of Texas at Brownsville (UTB/TSC), as defined by Chapter 51, Subchapter L of the Texas Education Code. The partnership combines the administrative, instructional, and support services of the upper-level university and the community college and eliminates the barriers between them. At UTB/TSC, students are able to complete an associate degree, then continue at the same campus until they complete a 4-year bachelor's degree. Master's degrees are offered in several fields.

The students of UTB/TSC are more than 90% Hispanic (93.8% in Fall 1998), and most students learned English as their second language. More than 65% of the UTB/TSC students are financial aid recipients (67.8% in Spring 1998). Table 1 shows the student enrollment from Fall 1996 to Fall 1998 and illustrates that up to 20.5% of all semester hours taken by TSC students are in reading, writing, and/or math developmental courses.

Table 1

Enrollment and Semester Hours for TSC

Semester	Fall 96	Spring 97	Fall 97	Spring 98	Fall 98
Students	6,892	6,835	6,857	7,201	6,770
Total semester hours	62,489	62,731	62,493	65,511	61,219
Dev. course sections	169	172	210	185	171
Dev. semester hours	12,828	12,636	12,617	12,637	9,747
% developmental hours	20.5%	20.1%	20.2%	19.3%	15.9%

Reading was not taught as a separate course in American schools until after Gray's identification of separate "reading skills" in 1936. For the next several years, reading remained largely a "research" discipline. The UTB/TSC Developmental Reading Program Review-Self Study 1994-95 (1995) described the philosophy before Gray: "Reading was not 'taught' but was something students 'learned.' The Gray reading tests introduced diagnostics into the rudimentary reading programs" (p. 1).

According to the Developmental Reading Program Review 1994-95 (1995), Holmes's sub-strata factor theory in 1953 stimulated both reading research and the development of classroom methodology. According to the reading program review, "The 'Sputnik' event in the late 1950's brought about the first real concerns about literacy in this country and inaugurated the 1960's expansion of reading programs in public schools" (p. 1).

At Texas Southmost College a general studies program that included reading was instituted in 1969 using local money. A reading lab was funded by Federal Title IV grant money that same year. Several grants continued the reading lab and expanded it into other subjects. In 1980 developmental education was included in the Statement of Purpose of TSC for the first time. The school committed itself "to provide developmental programs aimed at those who need to improve skills in order to succeed at college-level work" (Developmental Reading Program, 1995, p. 2).

Assessment of incoming students at TSC began in 1984. New students were given the Nelson-Denny Reading Test Form E by the counseling center at the time of enrollment until 1995. Students who scored less than 40 total raw-score points (approximately grade level 6.0) were advised to take College Reading I, and students scoring less than 53 total raw-score points (approximately grade level 8.0) were advised to take College Reading II. Students with acceptable scores were exempted from developmental reading courses. However, placement into developmental courses was not mandatory until 1986. The ACT-ASSET test replaced the Nelson-Denny test as the placement test beginning in the Fall 1995 semester (Developmental Reading Program, 1995).

In l988 the state of Texas mandated the Texas Academic Skills Program (TASP) examination for all new college students. Today all students are still required to take the TASP test at some time during their first 9 hours of credit courses. If they do not pass all parts of the TASP test (reading, writing, and mathematics), the students are required to take developmental courses in those areas until all parts of the TASP test are passed. For instance, if a student does not pass the reading portion of the TASP, he/she must take developmental reading courses until the reading portion of the TASP is passed.

The UTB/TSC Reading Department faculty suggested the addition of computer-aided instruction (CAI) as a way to improve student success and to reduce costs. Although computer equipment and software costs were high, faculty members concluded that "students would benefit from a combination of all treatments (print lab, CAI reading lab and classroom instruction), a more eclectic approach to teaching" (Developmental Reading Program, 1995, p. 15). After the initial purchase of equipment and software, maintenance and upgrade costs were expected to be small.

Beginning with the Fall 1994 semester, all developmental reading students at UTB/TSC were assigned to a new developmental reading course, which included a computer-aided instruction (CAI) reading lab. Because the CAI reading lab was established by UTB/TSC administration as a requirement for every developmental reading student, there was no opportunity for an experimental or quasi-experimental two-group study. Student success would be determined when a student achieved a passing score of 220 points on the reading portion of the TASP test. In September 1995 the required TASP reading score was raised from 220 points to 230 points.

From Fall 1994 to Spring 1996 this developmental reading course combined the use of conventional individualized materials in a traditional reading lab called the print lab, computer-assisted instruction (PLATO software) in a CAI reading lab, and teacher-directed instruction in the classroom. Students were instructed to complete 1 hour and 15 minutes of individualized instruction weekly in the print lab, to complete 1 hour and 15 minutes weekly in CAI, and to meet 1 hour weekly in a classroom with a reading instructor. During the 1994-95 academic year the CAI computer lab was plagued by insufficient numbers of computers, by problems with computer software and hardware, and by problems caused from the lack of technical and instructional support for the students when they worked in the lab. The DOS-based PLATO software, developed in the 1960s by Control Data Corporation and the University of Illinois, was in need of upgrading and improvements to run on the network in place. CAI was allowed to continue because more of the problems in the CAI reading lab were solved each semester.

In 1996 a larger CAI reading lab with 125 new computers replaced the smaller lab. A new Windows 95-based software package, Destinations by Invest Learning, was selected, and use of the new software began in the Summer II 1996 session. With the new Destinations software, the print lab and classtime components were dropped from the course, converting it to a lab with computer-aided instruction only. Although two to three peer tutors and a CAI reading lab supervisor are available in the lab, no class time or instructor is provided. The CAI reading lab is now locally called the CDI (computer-directed instruction) reading lab because the computer gives all instruction. This study uses the more common terminology, CAI reading lab. The CAI instruction software serves a large lab of students. Each student is scheduled to work in the CAI reading lab for 3 hours each week. Computer access is available from 8 a.m. until 10 p.m., and weekend hours are also provided. Vacant computers are available if students need to make up work due to an absence. Table 2 shows the number of students passing the TASP after using

Destinations CAI. Effort is made to assure that students spend the required 3 hours per week in the CAI reading lab, but many students do not. Students in this study averaged 13.9 hours per semester, significantly below the 45 hours per semester expected.

Table 2

Students Using Destinations CAI Passing the TASP

Semester	Number enrolled in develop. Reading	Number passing TASP	Percent passing TASP
Fall 1996	775	172	22.2%
Spring 1997	823	164	19.9%
Fall 1997	803	172	21.4%
Spring 1998	931	150	16.1%
Fall 1998	703	128	18.2%

Significance of the Study

Because Texas community colleges have open enrollment as provided by the Texas Higher Education Act of 1965, approximately 19.2% of the students enter TSC with deficiencies in reading ability, in mathematics competency, or in writing skills (see Table 1). A rapid growth in the number of students taking developmental courses began when the State of Texas implemented the Texas Academic Skills Program (TASP) in 1988. The self-study report described the change: “At this point, the number of developmental students and expenditures for remedial instruction increased significantly at this college and across the State" (Developmental Reading Program, 1995, p. 3). Texas remediation expenses statewide rose from $19.3 million a year in 1988 to $86 million a year in 1998. This rise of approximately 346% came during the time in which general revenue appropriations for higher education rose only about 72%, so college budgets across the state had to be cut in other areas (Breneman & Haarloe, 1998).

Breneman and Haarloe (1998) concluded that nearly one third of the nation's 1st year college students lack the basic skills to be successful in college without remediation. Boylan (1996) wrote, "Most large state higher education systems requiring mandatory assessment spend 10-15% of the undergraduate instructional budget on remediation." At UTB/TSC 57.7% of the total 1,187 first-year freshmen were advised to take reading remediation in the Fall 1997 semester, and 51.7% of the freshmen needed remediation in all three areas: English, mathematics, and reading (Ayala, 1998).

Colleges are seeking ways to improve the success of students in developmental courses, but also to lower the costs of the developmental courses. Some students in developmental reading do not complete the TASP test until after they have taken several semesters of developmental courses. Other students take the exam repeatedly without passing it.

Another financial concern many colleges have is the revenue lost because many students drop out of college without completing a degree. A 1998 report by the Office of Data Management and Reporting at UTB/TSC estimated that the total revenue lost due to attrition during the previous 5½ years was $106,769,651. The study explains that, if 10% of the students could be retained through intervention such as developmental courses, an additional $10.6 million in tuition, fees, and state funding would be available. Many students who do not pass the TASP test are lost to attrition (Office of Data Management and Reporting, 1998).

The CAI approach provides a computerized “tutorial” strategy to reading instruction. The computer guides students through lessons at their own pace as it seeks to teach the subject. “In theory, students are taught a skill, are tested, and depending on their responses, are moved along to another lesson” (Whitaker, Schwartz, & Vockell, 1989, p. 63). Whitaker et al. warned that computer instruction requires the student to have initiative and self-direction and that not all students will possess these characteristics. It is important to determine how efficient CAI is for teaching developmental reading students.

The National Center for Developmental Education conducted an extensive review of the Texas Academic Skills Program (TASP) in 1996. The study found that many remedial courses in Texas colleges were below professional standards. Boylan (1996) wrote:

> For instance, there are many cases where remedial courses are taught by adjunct and part-time faculty with modest qualifications in their subject area but little or no training to prepare them to work with underprepared students. In these cases, there is no evidence that current information from the research and literature of the field is integrated into remedial courses.

Boylan (1996) found that the quality of remedial courses provided in support of the TASP varies widely and concluded that developmental courses need ongoing and systematic evaluation but that evaluation was rare. According to Boylan, “Although there is a strong emphasis on compliance with TASP regulations among Texas colleges and universities there is little emphasis on accountability for the outcomes of TASP remediation".

An earlier study by Boylan, Bonham, and Bliss (1992) had found that only about 625 of the nation's more than 2,500 developmental programs engage in any ongoing and systematic evaluation activities. Boylan (1996) cautioned, "Research indicates that ongoing and systematic program evaluation in remedial/developmental education is significantly related to the success of students participating in such programs."

The report recommended that efforts be made to improve the quality of coordination in all Texas remedial/developmental courses and that all developmental courses and activities be evaluated on a regular and systematic basis (Boylan, 1996). When computer-aided instruction is involved, previous evaluations may become meaningless if equipment or software malfunctions or is changed.

The UTB/TSC CAI staff administered a Likert-scale student questionnaire that yielded promising results. In 1998, 75% of the students said that the lessons are interesting, and 87% said that they feel good to very good about CDI; "the lessons are helpful", 61%; "it is a good lab environment", 88%; and "help is always available", 96% (Ayala, 1998). Students in the CAI reading lab are able to choose the times they want to attend, and they do not have homework or final exams, as in traditional courses.

Because students enter developmental reading with greatly differing reading abilities and progress at different rates, it is difficult to determine how effective developmental courses have been. A method used by the National Center for Educational

Statistics (NCES) to evaluate developmental courses was to observe how many students passed the TASP test after developmental instruction.

An Annual Report on the TASP and the Effectiveness of Remediation August 1995 found that, nationally, approximately 75% of those who took developmental courses passed their assessment test within 1 year. In Texas the pass rate for TASP reading was 77.3%, using 1992-93 data (Texas Academic Skills Program, 1995). Boylan and Saxon (1998a) concluded, “A substantial percentage of those enrolled in developmental courses do, indeed, pass them (assessment tests) within one year.”

The success rate for CAI at UTB/TSC has been determined in the past by calculating the percentage of students taking the TASP test who passed. The pass rate of 50% in 1996 increased to 61% in 1997. However, since 24 fewer students took the TASP test in 1997, the actual increase in students passing the TASP went only from 110 students in 1996 to 114 students in 1997. The reason that fewer students took the TASP test was explained by Ayala (1998), “We try to discourage students from taking TASP until they have finished Destinations” (p. 29). The relationship between a student’s effort in Destinations CAI software and the student’s gain on the TASP test has never been calculated.

Theoretical Framework

With the constant advance of computer capabilities leading to major software upgrades or replacement with new CAI packages, the need for good decision making in selecting appropriate instruction software is continual. Many studies have been conducted to determine the effectiveness of CAI in various situations. Some studies have shown that CAI was effective (Child, 1995; Dixon, 1993; Newburger, 1996), but other studies have shown that CAI was not effective (Burke, 1992; Hardman, 1994). Unfortunately, most studies have not considered time-on-task as an independent variable in CAI effectiveness. Venezky (1984) described early studies by Rice and Eliot. Rice was the first to investigate the relationship between instructional time and learner outcomes. In 1893 he found that time spent on studying spelling past a certain amount did not lead to further achievement. In the 1890s Eliot found that, although curriculum guides specified that about 37 % of the school day was to be devoted to reading and English, the actual time children spent in reading throughout the first six grades totaled only 46 hours in the 6 years. According to Venezky, although surveys of reading instruction included assessments of instructional time, “few attempts were made prior to Harris and Serwer to relate instructional time directly to achievement” (pp. 20-21). Harris and Serwer determined in 1966 that some instructional tasks are productive for learning and some are not (Venezky, 1984).

Whitaker et al. (1989) described time-on-task as “academic learning time” and defined it as the time a student spends on relevant academic tasks “while performing those tasks with a high rate of success” (p. 17). They described good reading teachers as teachers who can help students make efficient use of academic learning time. Whitaker, et al. concluded that computers enhance learning if they increase the student’s efficient use of academic learning time.

CAI can have several advantages over traditional developmental reading courses. Automatic assessment and placement can be provided, and an individualized course of study can be prescribed for each student (Fletcher, Claire, & Gravatt, 1995). Students can work at their own pace, and CAI programs can include tutorials, applications, drills, practices, reviews, and mastery tests over each skill (Child, 1995). Also, small modules on each reading skill can require the student to succeed in learning one skill before going on to the next (Dixon, 1993).

Theories can be constructed that CAI reading instruction are successful in teaching developmental reading students for the following reasons:

1. The more time students spend working with CAI reading instruction (time-on-task), the better they will score on the TASP test.

2. CAI reading instruction providing assessment and developing an individualized course of study for each student will help the students improve their TASP scores.

3. Tutorials, application lessons, drills and practice lessons, reviews, and mastery tests over each skill as provided by CAI software will help students improve their TASP scores.

4. Students' enjoyment of CAI reading instruction will motivate them to learn more and to increase their reading ability.

Boylan and Saxon (1998b) described the process of summative evaluation, a method of evaluation, that examines a program after the process has been completed. Summative evaluation seeks to determine whether or not the services actually did what they claimed to do and to identify how well this was accomplished. Summative evaluation is designed to "judge the ultimate value or success of program activity."

In this study the criterion of the measure is the student's gain on the reading score of the TASP test. Evidence for this criterion is provided by pretest and posttest scores on the reading portion of the TASP test as recorded in the student's records. Judgment is possible as null hypotheses are subjected to statistical tests, including Pearson correlation and multiple regression.

Purpose of the Study

This study was conducted to determine whether the CAI reading lab is being used effectively at UTB/TSC to prepare students to pass the TASP test. Time-on-task is an important independent variable because it is possible to schedule students so that they will spend more time-on-task. If more time-on-task in the CAI reading lab will help students pass the reading section of the TASP test, more students will benefit, because they will complete developmental reading before they become discouraged and drop out of college. A quantitative study of the relationship between a student's time-on-task in Destinations CAI software and that student's progress on the TASP test will help faculty and students know the value of the CAI reading lab. Floud (1979) explained the value of such a study:

> In asking whether a relationship exists we simply wish to know whether two or more events are entirely independent of each other, or whether there is some connection, however tenuous, between them. Having decided whether a relationship exists, we can go on to ask how strong it is, and what form it has. (p. 131)

Statement of the Problem

The researcher sought to determine what relationship exists between time-on-task in computer-aided instruction using Destinations software and the gain in reading ability of developmental reading students as indicated by the reading portion of the Texas Academic Skills Program (TASP) test. Cohen (1970) described the seriousness of such research to the policy makers who must consider the serious financial problems that can result from accepting major changes in a program.

Hypotheses

Four null hypotheses were tested using Pearson correlation and linear regression statistics. These hypotheses are as follows:

H_{o1}: Students using Destinations CAI for more time-on-task will not have better score gains on the TASP test than students using Destinations CAI for less time-on-task.

H_{o2}: Females will not make better gains on the TASP test from time-on-task in CAI than males.

H_{o3}: Low-achiever students will not make better gains on the TASP test from time-on-task in CAI than high-achiever students.

H_{o4}: Time-on-task in CAI cannot be used to predict student gain on the reading portion of the TASP test scores.

Delimitations of the Study

Since fewer than 10% of the students were non-Hispanic, no attempt was made in this study to distinguish between ethnic populations. Only the semesters inclusive of Summer II 1996 to Spring 1998 are included in data analysis.

Limitations of the Study

A major limitation of this study is from the threats to internal validity. This limitation of the project was described by Fox (1997): "Although we can unambiguously ascribe an observed difference to an experimental manipulation, we cannot unambiguously identify that manipulation with the independent variable that is the focus of our research" (p. 9).

McMillan (1996) explained internal validity and the problem of other variables affecting the dependent variable.

> Internal validity refers to the extent to which the independent variable, and not other extraneous or confounding variables, produced the observed effect. A study is said to be "strong" in internal validity if most plausible extraneous and confounding variables have been controlled, and "weak" if one or more of these variables have differentially affected the dependent variable. (p.194)

Any pretest or posttest for reading has limitations because no one test is able to measure all the skills of developmental readers. Cohen (1970) noted that no one can measure all that a student learns. She wrote, "Test-taking, contrary to what many school personnel may believe, is not the basic goal of the educational process" (p. 8). Although the pretest and posttest used in this study are accepted by the college and recommended by the state of Texas, they cannot measure the development of all reading skills. However, the TASP test is the test through which all students in Texas are admitted into regular college programs, and thus TASP scores have relevance to this study.

The pretest-posttest model rules out selection as a rival explanation, but Kidder (1981) listed the five threats to the internal validity of the one-group, pretest-posttest design. The threats are (a) history, (b) maturation, (c) testing, (d) instrumentation, and (e) interaction of selection and maturation. These five rival explanations are potential threats for any study using the one-group, pretest-posttest design, and they were ruled out, in part, by limiting the conclusions from this study. Each of the rival explanations is described below.

History

The posttest is not taken until several months after the pretest (perhaps as long as a year or 2 years later), so some of the difference between the posttest and the pretest scores results from history. The student is now a college student, pressured to study (and to read effectively) by faculty in other courses. Surely hours spent studying history, literature, psychology, science, and other books can help the student learn to read. Regular exams in these other courses challenge the student to read effectively and to remember facts from textbooks, library books, and magazines as never before. No meaningful study of college reading effectiveness in which time is a factor would want to isolate the student from the rival explanation of history. Multiple regression was used in this study to determine what portion of the student's progress could be attributed to time-on-task in CAI.

Maturation

New college students are maturing during the 1st year or 2 of college. They have become independent in many ways after leaving high school; some are working, some are married, and most have less family control over them. They have become responsible for their own learning as never before. It is hoped that also they have become more able to take exams. Maturation is a rival explanation for the student's success, but multiple regression was used to determine what portion of the student's progress could be attributed to time-on-task in CAI.

Testing

The tests taken in this study are required for every student entering college. Taking the pretest can affect developmental students if they fail to make acceptable scores on the test. The pretest is given to assess the student's reading ability, and the score indicates whether or not the student needs to acquire more reading skills.

Additional tests are used in a prescriptive way in CAI, helping students focus on skills they need to learn. Students should become more comfortable taking tests and would be expected to improve their grades on the posttest, although some do not. When the same test is used for pretest and posttest, the repetition of the test can affect the student's grade on the posttest. This study used multiple regression to determine what portion of the student's progress could be attributed to time-on-task in CAI.

Instrumentation

Students are randomly given different forms of the TASP test when they take the pretest and the posttest. These tests are equivalent tests and can be subtracted to determine the student's gain in reading skills. These differences are used for correlation tests, but by using multiple regression, transformation methods standardize the pretest and posttest variables. Dometrius (1992) described the process:

> The standardizing process first identifies for a case the deviation above or below the mean of the variable ($Y - \underline{Y}$) and then transforms that distance to standard deviation units (divided by S_Y). As in other transformations discussed earlier this change does not affect what the variable measures; it just modifies the scale used for the measurement. (p. 423)

This transformation is a part of the multiple regression process so that a unique variance between the two scores can be assessed. The variance between the pretest and posttest scores was used as a measure of the gain in reading skills.

Interaction of Selection and Other Threats

This threat considers that the group selected may react to one of the other threats to internal validity in a way that is different from the way that other groups react. Using a large sample can control this threat (Kidder, 1981). In this study, including the entire population was used to control for this threat.

Definitions of Terms

Computer-aided instruction (CAI)--Any instruction that is given to a student by a computer program is computer-aided instruction. CAI is individualized, interactive, and guided, and it serves as a tutor for one individual (Miller, 1995). The CAI program used in this particular study is the reading portion of the Destinations software by Invest Learning. This CAI program assesses the student's reading skills by using criterion-referenced tests and then prescribes a series of exercises, including instruction and practice. The student must pass a quiz over each skill to go on to the next skill.

Computer-directed instruction (CDI)—CDI is an acronym for computer-directed instruction chosen by UTB/TSC officials to describe the CAI reading and math labs at UTB/TSC. When computer-aided instruction is used as the only instruction students receive, it can be called CDI, or computer-directed instruction (Ayala, 1998).

Texas Academic Skills Program (TASP) test--Successful completion of the reading portion of the Texas Academic Skills Program (TASP) test continues to be the state-mandated measure of the student's success in developmental reading in Texas. The passing score was increased from 220 to 230 in 1995. These exam scores, successful or not, are filed in the institutional records of the student's work.

Developmental reading--Developmental reading is a course designed to help students who are classified as developmental reading students because they failed to earn an acceptable score of 230 points on the reading portion of the TASP test or were judged to be in need of remediation by a local reading placement test.

Developmental student--A student who is judged by state or college guidelines to need remedial instruction before taking college work is a developmental student. The

Texas Education Code (1987) defined developmental students as those students who have not passed the TASP test within the first 15 semester hours of college credits. The law also allows schools to use an additional assessment test and to place students not making a satisfactory score on the assessment test into developmental studies.

Day and McCabe (1997) described developmental students as those students who enroll in college underprepared for college-level mathematics, writing, or reading. They list the sources of the developmental students:

> Many (students) come from deprived circumstances and often attended inadequate schools. Some were not enrolled in college bound programs and failed to develop the skills required to compete in college. Others received diplomas and entered the workforce only to find years later that they needed to refresh their skills when they entered college. As a result, most require limited remediation, perhaps in only one of the three traditional basic skills, and are likely to improve and complete their education rapidly. Others, however, require extensive remediation in each of the three basic skills and more likely to struggle to complete their degree program over a prolonged period.

In 10 years, according to American demographics for 1989, over 66% of the youth of the nation are ethnic minorities, and by 2010, over 50% of those entering the workforce nationwide will be minorities (Day & McCabe, 1997).

High-achievers--Those developmental reading students in this population making pretest TASP reading scores above or equal to 202, the mean pretest score for this population, are defined as high-achievers for the purpose of this study. High-achievers totaled 293 students (60.8% of the population).

Low-achievers--Those developmental reading students in this population making pretest TASP reading scores below 202, the mean pretest score for this population, are defined as low-achievers for the purpose of this study. A total of 189 students (39.2% of the population) was classified as low-achievers.

Time-on-task--Time-on-task is the measure of a student's actual participation in CAI activities. This variable is commonly recorded by CAI software and is the time the student is working on CAI activities, including tutorials and tests. Whitaker et al. (1989) called this time-on-task "academic learning time (ALT)," and they agreed that the computer makes an important contribution to ALT in reading. They warned that, "in most situations in which computers enhance learning, they do so because they increase effective academic learning time. When computers fail to improve learning, it is often because they do not increase ALT" (p. 18). Whitaker et al. suggested that teachers should look for areas in which CAI will increase the academic learning time available to students: "The computer can play a vital role because it has the capacity to both motivate learners and focus their attention more effectively on the task at hand (p. 19). The Destinations time-on-task was rounded off to the nearest hour before it was recorded in the student CAI records. The time-on-task used for this study, therefore, is the time the student has worked on Destinations software after the pretest TASP score and before the posttest TASP score, rounded to the nearest hour.

Summary

When the Texas legislature mandated the TASP test for Texas colleges and universities in 1988, large numbers of students were required to enroll in developmental courses for the first time. UTB/TSC began using a CAI reading lab with Destinations software in Summer II 1996 and continued through the Spring 1998 semester, but the college has not evaluated the effectiveness of the developmental CAI reading course in a meaningful and systematic way (Ayala, 1998).

Computers continue to advance in capabilities and ease of use. Computer software has developed from monochrome text-based programs a few years ago to programs with graphic ability, then animation, and then color and sound. Computer software continues to improve, and digital-video has been added to some CAI software. Colleges need a way to determine the effectiveness of these CAI software changes because, as Balajthy (1989) warned, "computer-based education is a technological potential, not an educational guarantee" (p. 70). An evaluation of CAI software completed several years ago cannot apply to CAI software used today because the software is not the same. Balajthy explained that CAI reading projects often ignore the reading process and the software used to teach it.

> A good example of this is the large body of material written about the effectiveness of PLATO, as if this system . . . were uniform in quality. Only the hardware is uniform; anyone familiar with the PLATO software will quickly realize that it varies tremendously in effectiveness. (p. 71)

CAI research suffers from the flaws that typify much educational research. It is impossible to carry out “laboratory-perfect studies with real human beings in real classrooms” Balajthy, 1989, p. 77). According to Balajthy, in a field changing as rapidly as computer-aided instruction, results from research projects are out-of-date almost as soon as they are reported. He wrote,

> Few large-scale efforts have been made to determine how computers are actually being put to use today. Surveys that have been made are based on self-reports by teachers and administrators, a survey methodology that can lead to misleading conclusions. (p. 84)

A one-group study using pretest and posttest data will provide a method of evaluation that can be used in a regular and systematic way. Although such a study has many limitations, this type of evaluation can provide useful information about the success of various adjustments made each semester. A calculation of the correlation between variables is helpful, but when multiple regression methods are added to the study, the researcher can extract more information from the data (Dometrius, 1992).

CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

Reading education has been the subject of more than 15,000 books and articles, according to Venezsky (1984), whose catalogue of works is described in What Research Has to Say about Reading Instruction (Otto, 1992). Many journals and magazines about reading and reading research are published each year. These periodicals include: Australian Journal of Reading, Journal of Reading, Journal of Reading Behavior, Journal of Research in Reading, New England Reading Association Journal, Reading Improvement, Reading Psychology, Reading Research and Instruction, Reading Research Quarterly, The Reading Teacher, and Reading World.

The complexity of teaching reading is illustrated by descriptions of four learning models that have been used. In the behaviorist model teachers transmit information to students and reinforce it through repetition, rewards, and feedback (cf. Thorndike's stimulus-response theory in 1932 and Skinner's theory of operant conditioning in 1968). After students should have learned the information, objective tests measure how successfully the information was learned (Willis, Stephens, & Matthews, 1996).

Constructionists believe that knowledge is constructed by each student's activities. These teachers provide exploratory situations so that students can be involved in problemsolving situations. They are allowed to experiment, to make mistakes, and to work with peers to find answers to the problem (Willis et. al., 1996).

A third model follows the mental discipline theory based on the writings of Wolff. Proponents compare the mind to a muscle that improves with exercise. Studying particular subjects will expand mental facilities such as memory, reasoning ability, and imagination (Willis et. al., 1996).

A fourth model is called scientific management. This model was introduced to factories by Taylor and was applied to schools by Kliebard in 1987. This model begins with careful specification of the task to be performed, and then each element of that task is ordered to the most efficient sequence. Each of these models has been applied to reading instruction in one way or another (Willis et. al., 1996).

Reading involves a large number of complex skills, and theories about how these skills interact continue to change in the literature. Theories should consider teacher competencies and decisions, student perceptions and attitudes, and classroom and school reading environments (Hoffman, 1986). A particular reading difficulty may be caused by multiple factors, and these factors are not always related to instructional solutions (Chall & Curtis, 1992).

Computer-aided instruction (CAI) has also changed in many ways. During the years since the first CAI programs were written in the BASIC language for an Apple or Radio Shack computer, computers have advanced and evolved. Computers more powerful than those that put a man on the moon or controlled a large corporation now sit on students' desks or perhaps in students' laps. Major advancements in computer abilities are introduced each year. Balajthy (1989) observed, “In addition, in a field as rapidly changing as computers in education results of such research are out-of-date almost as soon as they are reported” (p. 84).

This chapter presents a discussion of the literature findings about reading skills, developmental education, computer-aided instruction, the TASP test, and Destinations software. Literature findings about the study variables, time-on-task, TASP score gains, gender, and high and low-achievers are followed by a section concerning the contributions this study will make to the literature.

Reading Skills

Training in specific reading skills has been shown to be successful in helping developmental reading students. If a student is weak in one area, such as vocabulary, comprehension, word analysis skills, or reading rate, training for the missing skill is possible (Spache, 1976). When the student has deficiencies in several of these skills, diagnosis and remediation are much more extensive. According to Spache reading disabilities develop gradually over time, and diagnosis is a continuous process of proposing hypotheses about the student’s training needs, testing the teaching strategies with the student, and then referring or discarding the strategy. He advised, “We must constantly observe the pupil’s behavior, responses to the approach we are using, and its apparent impact upon his development” (p. 9).

The teacher should not think of treatments as curative, but rather as steps that we take to help the student’s immediate problems in reading. According to Spache (1976), “All we can derive from the facts that we have accumulated are clues to probable causes, clues to be tested by related treatment when this is conceivable” (p. 10).

The reading teacher has the difficult task of trying to find ways in which each student learns and then using those methods in a consistent way to teach the student the reading skills needed. Small classes are required so that the teacher has the necessary time to work with the students (Spache, 1976). Efforts to determine a sequence for reading skills have been unsuccessful. Spache stated that White in 1973 reviewed the research, seeking a hierarchy of interlocking reading skills such as the skills required for word analysis. He found that the research to support the idea of a hierarchy was poor and inconclusive. Spache observed, “There is almost no definitive research clarifying how the sequence of skill development should be arranged nor exactly which skills are definitely prerequisite to later skills” (p. 213).

Although the basal reading system emphasizes word analysis skills in teaching reading, reading specialists continue to debate how essential these skills are for successful reading. The basal reading system is highly structured, skills-oriented, and well organized. It is composed of student readers, teacher manuals, and supplemental materials, including workbooks, tests, management systems, duplicating materials, software, cassettes, games, charts, and other items (Whitaker et al., 1989). Spache (1976) explained:

> For the past half-century at least, every basal reading system in America has emphasized these abilities as though they were basic to learning to read. Yet the evidence in studies that have attempted to measure this relationship is not entirely supportive of these practices. (1976, p. 211)

Studies continue to show that good comprehension does not always follow from good word analysis skills. Nurss and Hough (1992) observed, “Students who interact with the text are more likely to read fluently than are those who focus on decoding the text” (p.294). Word analysis needs to develop as the students’ background knowledge and experience are related to the text. Students can develop reading vocabulary by using their own sociolinguistic context (Nurss & Hough, 1992). Although training in word analysis skills is the most likely part of developmental reading instruction, there is little research indicating that pupils make much use of their exposure to this instruction (Spache, 1976).

Word analysis skills are likely to be included in any CAI reading program, but each of these skills has been objected to by other scholars. Phonics, for example, is such a popular reading skill that some claim that children must be taught phonics or they will not learn to read properly. In the phonics system students learn techniques for “sounding out” unknown words (Whitaker et al., 1989). Spache (1976) gave the following warning about phonics:

> Letter-sound associations (phonics) are an aid to beginning reading, not a method of learning to read. Although reading does involve translating printed symbols into auditory memories of spoken words, this is only the primary step in the entire act of processing, interpreting, reacting to, and assimilating what is being read. (1976, p. 218)

Other teachers claim that the structural analysis of words is the key to learning reading. Students learn Greek and Latin stems so that they will understand the words derived from those roots. But Spache (1976) asked, “How many of the hundreds of Greek and Latin stems can children really learn and apply?” (p. 223).

Even skilled remedial workers often cannot establish why a student has a reading disability. According to Spache (1976), “We are handicapped in treating the causes, such as intelligence, previous instruction, socioeconomic status, parental attitudes, and personality maladjustment of the pupil” (p. 340). The reading teacher treats the symptom to give temporary relief to the student, and the reading performances usually improves to some degree (Spache, 1976).

Balajthy (1989) listed two important principles of reading and writing instruction for older students:

1. Curriculum should stress the process and tools of learning instead of subskill rules about reading.

2. The curriculum must closely match and augment the student’s content curricula. He warned that most college reading courses do not last long enough for any substantive vocabulary improvement. “The deficiencies accumulated over twelve or more years of elementary and secondary schooling (cannot) be corrected in a single semester” (p. 20).

The success of reading instruction continues to rest on a combination of the available resources, the attitudes and competencies of teachers, and the entry-level abilities and interests of the students (Venezky, 1984). Venezky described reading research as fragmented and isolated. The two areas of current research are, (a) understanding the basic nature of the reading process, and (b) a renewed search for better methods of teaching (Kamil, 1984). Kamil encouraged the use of descriptive data collection: “In this approach, for educational research, the emphasis is on the description of educational practice, not validation. A goal might be to identify 'successful' or 'nonsuccessful' instructional components, methods, or environments (p. 43).

Developmental Education

In 1994, of the nation's 12,539,820 undergraduate students 23% were taking developmental education at some time during the academic year. A total of 520,551 full-time faculty and some part-time faculty served these students. The Annual Report on the TASP and the Effectiveness of Remediation August 1995 found that only a small percentage of the nation's higher education personnel resources are devoted to developmental education (Texas Academic Skills Program, 1995).

The cost of developmental education was defended by Day and McCabe (1997), especially for community colleges because it contributes to the economic and social strength of the nation. According to the authors, "One of the great strengths of our country has been the commitment to fully develop the talents of every American."

Day and McCabe (1997) noted that 40% of the community college students are underprepared for college courses and that minorities are three times more likely to enter college underprepared for collegiate study. About two thirds of the underprepared students enrolled in remedial courses complete them in less than a year. Seventy-five percent of the entering underprepared students are retained through the 1st year.

The estimated annual cost of $1,000 per student for remediation is much less than the annual cost of welfare ($22,348) or incarceration ($26,000) (Day & McCabe, 1997).

Day and McCabe explained their support for remedial education:

> In a democratic society, higher education is one of the means of gradually reducing the inequality of the human condition. Thus, while the monetary returns from education alone are probably sufficient to offset all of the costs, the nonmonetary returns are several times as valuable…the costs are low and the success rate is impressive.

According to An Evaluation of Developmantal Education in Texas Public Colleges and Universities, the Texas Academic Skills Program (TASP) was created by the Texas legislature in 1987 and was first administered March 1989. Students judged to have academic skill deficiencies in reading, writing, or mathematics must participate in remediation programs until demonstrating skill mastery by passing all three sections of the TASP test. Although the Texas Education Code, Sect. 51.306 (1987) requires all skill-deficient students to participate in remediation, it does not describe the nature or extent of the remedial interventions (Boylan & Saxon, 1998a).

The Annual Report on the TASP and the Effectiveness of Remediation August 1995 stated that, "because the law requires all skill-deficient students participate in remediation, controlled experimental studies designed to isolate the effects of remedial programs cannot be conducted" (Texas Academic Skills Program 1995).

According to the Higher Education in Texas: 1998 Status Report (1998) higher education institutions in Texas report that as many as one half of the students enroll in college without the reading, writing, and mathematics skills they need for success in college courses. The evaluation noted that between 30 and 48% of students failed one or more of the test's three skill sections at any particular administration of the test. Effective with the Fall 1998 semester, entering students must take the TASP test before enrolling in any college coursework. The 75^{th} Legislature added a rider in the General Appropriations Act, directing that those developmental education funds be granted through a performance-based process. The fund allocations are based on the number of students who successfully complete developmental education by passing all sections of the TASP.

Computer-aided Instruction (CAI)

Since the many CAI computer programs are different, generalization from study to study is not possible. Some of the studies and their results are described as follows:

Boyer (1990) cited Littman, who reported in 1987 that compensatory (at-risk) students using CAI showed academic gains: "For each month in the program, the student showed at least one month grade equivalent (gain)...The average gain for the compensatory population was 5.6 months over an 8 month period" (p. 5). A 5-year study by the Los Angeles Unified School District with academically weak students showed that "students using the computer only 10 minutes per day raised scores a significant amount. Increased time on the computer, therefore, brought an increase in results" (Boyer, 1990, p. 5).

Boyer (1990) described her study, using her original software program and workbook titled Reading Comprehension, along with a commercial reading program titled Our Weird and Wacky World by Educational Activities. Computer time as well as workbook time gave 19 students in the experimental group 14 hours of extra reading comprehension experience. Her quasi-experimental study showed that 17 of the students increased their reading grade level by more than 1 year. One student stayed the same, whereas the other increased 7 months (pp. 8-12). Boyer stated, “The overall increase of both grades (4 and 5) showed the computer group increased 5 months more than the control group, who did not use the computers” (p. 12). The study used the same version of the test for pretest and posttest. There were 19 students in the experimental group and 35 in the control group. Since the experimental students had additional hours in CAI and the workbook, the gain cannot be attributed to CAI alone.

According to Williams (1993), Braun found that technology in the hands of trained teachers is especially powerful when used with at-risk students. He also described Bialo and Sivin, who found in 1990 that a technology-based instruction was more effective than more traditional approaches. (p. 9)

In a single-group study, 54 randomly selected students’ scores on the Stanford Achievement Test (SAT) were compared by Williams (1993) before and after CAI using the Computer Curriculum Corporation (CCC) software.

> The CCC software provided immediate feedback, allowed students to work and progress at their own level, varied the amount of response time, provided up-to-date analysis of individual and class progress, and claimed to provide a 70% to 80% success rate. (p. 15)

Williams (1993) described the statistical results: “The results yielded an F Ratio of 3.5353 and an F probability of .0007 which was significant at the .05 level of probability in the area of Reading Comprehension” (p. 16). This study of sixth-grade students is especially interesting because over 90% of the students are minority and many would be classified as at-risk students due to the poverty in the area. Williams also noted, “The time spent in the CAI lab must also be evaluated. A student who seems to benefit from CAI but is not showing significant gains may need more lab time” (p. 20). This study did not examine the time spent in the CAI reading lab.

Williams (1993) included a warning from Kendl and Broihier that, as the technology becomes more familiar, its novelty will wear off and students’ outcomes will decline. If this is true, continued use of CAI may not be as successful as it is the first time it is used.

A more extensive study by Seaman and McCallister (1988) included the computer software Computer Curriculum Corporation (CCC), Comprehensive Competencies Program (CCP), Control Data’s PLATO system, and IBM’s PALS system. The study included two experimental groups, one receiving 4 weeks’ CAI, and the other 6 weeks’ CAI. There was no control group. There were two sets of students in each CAI group, one set working with the systems for 4 weeks, and a second set working for 6 weeks. Participants were given the Test of Adult Basic Education as pretest and posttest in the areas of reading, mathematics, and language. According to Seaman and McCallister, “With lower level students, the more effective CAI systems are those that are integrated with traditional teacher/student instruction. CAI systems are excellent support systems for instruction, but do not replace the need for teacher/student interaction” (p. 5) They also concluded, “It (PLATO) is useful with self-motivated students who have sufficient skills to work in self-directed situations” (p. 5).

A study by Schoener (1990) included 4,656 students receiving face-to-face instruction and 3,287 students receiving CAI. The majority of the CAI students received CAI by itself, while 24% received a combination of CAI and face-to-face instruction. Nearly one half of all students receiving computer-assisted instruction used ESC software, WICAT, CCC, PLATO, or CNS software. The curriculum varied by software package, but they have a common principle of mastery learning: A student must sufficiently master the information at one level of difficulty before moving on to the next level. Only 12 of the 38 teachers used the initial placement test accompanying the software package. In the program, students were expected to make statistically significant mean gains from pretest to posttest on the standardized reading tests. The conclusion was that "on the Reading Comprehension subtest of the CAT, students in grades nine through twelve who received face-to-face instruction made mean gains that were significantly higher than those for C.A.I. – only, or combination services students". (p. 41)

An additional conclusion is suspect, because most of the teachers did not use the CAI software the way it is designed to be used (with placement tests). Schoener (1990) stated, "Successful implementation of C.A.I. depends on the capacity of the software to respond to the needs of students and on the teacher's skill in guiding students through the curriculum" (p. 62).

Many other studies of CAI effectiveness have been published since the first computer programs were written. Some claimed that CAI was better than classroom instruction, and some claimed that classroom instruction was better. The CAI programs range from self-written programs covering a single purpose to large programs elaborately written by the author; they also range from small published programs to large, expensive, multisubject commercial programs. Most studies lack internal validity, and many are simple summaries of the mean grade scores. Studies made with a self-written CAI program on one Apple II computer in the corner of a classroom do not generalize to a CAI reading lab where every student has a computer and the computer uses modern CAI programs with graphics, sound, and video.

The TASP Test

The national use of standardized tests for reading assessment began in 1965, when Congress mandated national periodic assessments of American students. In 1988 Congress passed legislation allowing state-by-state NAEP comparisons, "raising the specter of high-stakes national testing" (Hiebert & Calfee, 1992, p. 76).

For the past 3 decades, reading assessments have been dominated by externally developed and mandated tests. Hiebert and Calfee (1992) explained the advantage of standardized tests,

> Large-scale standardized tests gather the same information under the same circumstances from all students. In a certain sense, tasks like the directed reading lesson, with its typical questioning of vocabulary and comprehension share the aim of eliciting similar information from all students. (p. 89)

Standardized tests provide assurance that achievement data do not vary widely in meaning among teachers, that performance data are gathered in a standardized manner, and that the outcomes can be aggregated.

Hiebert and Calfee (1992) warned "assessing the achievement of students whose first language is not English is a particular challenge," because the tests are created for English-speaking students. (p. 91)

Standardized tests often claim to test more skills than they actually can test. Spache (1976) explained as follows:

> The list of comprehension skills that group reading tests claim to measure is almost endless. Some writers enumerate at least fifty to sixty, and a review of current group tests indicates that they claim to measure at least twenty to twenty-five of these. (p. 252)

Factor analyses of groups of tests to identify common components have seldom succeeded in finding these discrete skills. According to Spache, "All that group tests appear to measure--no matter what the titles claim--are the three elements of a word meaning factor, a relationships-among-ideas factor, and a reasoning factor" (1976, p. 252).

Other educators, such as Hiebert and Calfee (1992), worry that standardized instruments measure only low-level basic skills.

> Some of the more readily identified problems with performance tests are that time may limit test coverage to one or two topics, students who have not been effectively taught to express themselves in writing or speech may be at a disadvantage, and subjective evaluation allows the possibility of bias. (p. 87)

Diagnostic testing of word analysis skills by commercial tests is limited. According to Spache (1976), "Of the twelve or thirteen skills that conceivably should be tested, no available test includes all of them. Those skills included are only sampled, not covered thoroughly" (p. 228). Spache described these tests:

> Some instruments attempt to sample a number of comprehension skills in such brief subtests that they become simply measures of rate in various contexts. Some tests sample comprehension and rate in bits and pieces of reading matter, while others employ much longer examples of continuous reading. Obviously these different approaches to measurement of the same skill area cannot yield comparable results (pp. 252-253).

Because the tests are limited in scope, there are harmful consequences of allowing test content and format to dictate the curriculum. Cannell in1988 reported inflated test scores, which he attributed to "teaching to the test" (as cited in Hiebert & Calfee, 1992, p. 71). Resnick and Resnick described "what is tested is what is taught" as an important reality of school reform in the 1980s, "which equates learning with higher test scores" (as cited in Hiebert & Calfee, 1992, p. 76). Tuinman (1971) in "Asking Reading-Dependent Questions" cited a number of analyses of several common reading comprehension tests in which many of the questions could be answered without reading the text. Students sometimes answered almost as many questions before reading the text as they answered after reading the text.

Hiebert and Calfee (1992) described the past decade as a time of enormous shifts in educators' views of reading comprehension, from a focus on specific skills and objectives toward a definition of reading as the reconstruction of meaning. They stated, "The pipeline between reading research and test publishers seems less open at present;

popular tests of reading comprehension have not changed much over the past decade" (p.75). One of the recent tests to include reading is the Texas Academic Skills Program (TASP).

The Texas Academic Skills Program (TASP) was created in response to a report prepared by the Texas Higher Education Coordinating Board in July 1986, titled A Generation of Failure: The Case for Testing and Remediation in Texas Higher Education. This report called attention to the problem of underpreparedness in the academic skills of many Texas college students. In response to this report, the Texas legislature, under Section 51.306 of the Texas Education Code (1987), stipulated that all students entering Texas public colleges and universities must be assessed in the areas of reading, writing, and mathematics. Any student who does not demonstrate mastery on one or more sections of this assessment must undergo continuous remediation until such time as mastery is demonstrated. The Texas Higher Education Coordinating Board (THECB), the Texas Education Agency (TEA), and National Evaluation Systems, Inc. (NES) worked together to create the basic skills test, the TASP test, which was instituted in 1989 (Texas Academic Skills Program, 1998).

A number of programmatic changes implemented in 1993 affected the TASP test. These changes included exemptions from the TASP for students who perform at specified standards on the Scholastic Assessment Test (SAT), the American College Test (ACT), or the Texas Assessment of Academic Skills (TAAS). Another change was that all students must attempt the test by their 9th college hour. Finally, changes in the assessment instrument made the test longer and slightly more difficult (Texas Academic Skills Program, 1998).

The reading section of the TASP test consists of approximately 40 multiple-choice questions matched to reading selections of about 300 to 750 words each. The selections represent a variety of subject areas and are similar to reading materials that students are likely to encounter during their 1st year of college. These skill areas are included in the reading section of the TASP:

1. Determine the meaning of words and phrases.
2. Understand the main idea and supporting details in written material.
3. Identify a writer's purpose, point of view, and intended meaning.
4. Analyze the relationship among ideas in written material.
5. Use critical reasoning skills to evaluate written material.
6. Apply study skills to reading assignments.

An overall test reliability estimate for the TASP test is provided by the Kuder-Richardson index of item homogeneity (KR-20), reported in the range of 0.00 to 1.00. A higher number indicates a greater level of reliability. Reliability concerns the extent to which a measure consistently produces the same result under similar conditions. The test forms administered September 1996–August 1997 showed a mean raw score 25.3–26.8 and a KR-20 reliability of 0.80–0.85 (Texas Academic Skills Program, 1998).

According to the NCDE evaluation study, a majority of those who fail the reading portion of the TASP test and receive remediation pass it on their second attempt. The study found that “those who fail the reading or writing sections and receive remediation are likely to obtain a C or better in their first college English course" (Boylan & Saxon, 1998a).

The study continued:

> Among the students who repeated the TASP test following remediation, 41.8% passed in mathematics, 57.6% passed in reading, and 75.3% passed in writing. Remediation appears to have a beneficial effect for most students who participate in it and retake the TASP test (Boylan & Saxon, 1998a).

Boylan and Saxon (1998a) concluded that students failing a section of the TASP test a second time are at considerable risk, especially if they are minority students. The study found that, "although the TASP appears to be fair for all students, it is more effective for white students than for ethnic minority students."

The Annual Report on the TASP and the Effectiveness of Remediation July 1996 stated that 96% of the remediation at community and technical colleges was course-based remediation, and at universities 65% of the remediation was course-based. Noncourse-based remediation, which involves developmental labs and computer-aided instruction, accounted for the remainder (Texas Academic Skills Program, 1996).

The NCDE evaluation found that almost all of the various learning centers used technology to provide some individualized learning. Boylan and Saxon (1998a) suggested that using computer-assisted instruction as a supplement to classroom instruction may be beneficial in maintaining appropriate class size limits, but added this warning, "Note: Research has consistently shown that using computers as a primary means of instructional delivery is not effective for developmental students. It can, however, be quite effective as a supplement to regular classroom instruction."

A cohort study was completed for the Annual Report on the TASP and the Effectiveness of Remediation July 1996. The cohorts studied were first-time entering freshmen who remain in school for at least 2 semesters. The study found that, if a student completes remediation, that student is retained at a rate of 12 to 15 percentage points higher than for the cohort total Test Section Skills and Skill Areas (Texas Academic Skills Program, 1996).

Destinations CAI Software

Invest Learning, of the Simon & Schuster Education Group, developed Destinations software in 1989. The CAI software is being upgraded to CCC Destinations 2.0, developed to run on a network or over the Internet. It includes over 15,000 learning activities (including math and writing) and a management system. The company describes Destinations software as a "comprehensive library of curriculum designed especially for the adult and adolescent learner who may not have succeeded in traditional educational environments" ("Evaluation Studies", 1998).

The Computer Curriculum Corporation (CCC) has provided educational software since 1969. CCC was sold to Simon & Schuster in 1990. In 1998 companies including Simon & Schuster combined to form Pearson Education. An article published in the Electronic Education Report in 1997 described CCC as the largest publisher of electronic instructional materials for United States K-12 schools. "CCC captured an estimated

18.5(%) of the U.S. school market in 1996" ("Business Intelligence on Opportunities in the Educational Software Industry", 1997).

Topics covered by CCC Destinations reading software include vocabulary development, comprehension, critical reading, reading in the content area, spelling, usage, and parts of a book. The scope and sequence of the software is listed in Table 3 ("Meeting Student Goals", 1998).

Table 3

Scope and Sequence of Destinations Courseware

Visual/perceptual skills

- Shapes, Letters, Words and Phrases

Vocabulary

- Basic Sight Words (survival words most commonly used in daily life)
- Root and Base Words
- Compound Words
- Prefixes and Suffixes
- Synonyms and Antonyms
- Homophones and Homonyms
- Homographs/Multiple Meaning Words
- Context Clues

Comprehension/Critical Reading

- Derive Sentence Meaning

Identify and Analyze Setting and Mood of a Story

Identify and Analyze Feelings, Traits of Characters

Identify Main Idea (stated and implied)

Classify/Sequence events

Analyze Plot

Recall/Locate Essential and Nonessential Details (who, what, where, when, why, how)

Differentiate Fact from Opinion

Identify Cause and Effect (stated and implied)

Draw Conclusions (global and specific)

Make Inferences (global and specific)

Master Analogies

Determine Author's Intent & Purpose

Employ Skimming and Scanning Techniques

(table continues)

Compare and Contrast

Comprehend Literature and the Arts Texts

Science and Social Studies Texts

Use Context Clues (example, definition, synonym, comparison, contrast)

Summarize

Analyze Logical and Illogical Arguments

Recognize Conventions of Poetry

Recognize Dramatic Devices in Stories and Plays

Content Area

Vocational Awareness

Civilizations

Health

Family Relations

Famous Americans

Holidays

Science

History of Science

Literature and the Arts

Social Studies

Social Science

Spelling

(table continues)

Common Sight Words (including many consumer, survival and work-related words)

Contractions, Compounds, Plurals

Derived Forms of Basic Sight Words

Words Most Frequently Encountered on Tests

Common Technical Words from Science Topics

Common Technical Words from Social Studies Topics.

Language Skills

Common and Proper Nouns and Pronouns (identify, choose correct singular or plural forms; select the noun that a pronoun represents)

Action and Linking Verbs (identify and use past, present and future forms--regular and irregular; identify and use past participles of verbs)

Prepositions (identify and use)

Word Families/Consonant Substitution

Parts of a Book

Dictionary (alphabetical order, guide words, choosing the best meaning)

Encyclopedia

Atlas

Almanac

Thesaurus

Other References (newspaper, telephone directories)

Although a major educational technology publisher now distributes Destinations software, the program is relatively new and has not been subjected to major research. A few brief descriptions of schools using Destinations are listed on the company's Internet site.

Cumberland Campus of Nova Scotia Community College described its use of the program, claiming that after just 6 weeks of instruction, students improved an average of nearly four levels in reading. ("Results: Community College", 1998). El Centro College in

Dallas, Texas, described their Destinations lab, which served 13,000 students the 1st semester, as a TASP preparation lab “with time on task accountability requirements tracked by the state-of-the-art CCC Management System.” No evaluation information was given. (“Results: Community College”, 1998).

The most complete research study is one conducted in conjunction with the League for Innovation in the Community College. A 2-year research study called Project LEAP was conducted to determine the effectiveness of the “INVEST In The Future” courseware in developmental education. A news report titled “League for Innovation Releases Final Results of the Developmental Education Demonstration Project” described the results of the study. “The study documents impressive student retention rates in all of the participating colleges and a variety of successful instructional models community colleges can use to improve their own developmental programs” (Johnson & Perez, n.d.). Only Kingwood College had a lab with no teachers. The report stated, “Even with limited guidance and resources, 56 percent of these students completed the semester successfully” (Johnson & Perez, n.d.). The criteria used to judge “successful” were not listed.

Destinations software has been aligned with various national, state, and local curriculum standards. Some of these standards are listed in Table 4 (“Curriculum Standards”, 1998).

Table 4
Curriculum Standards Aligned to Destinations Software

National Alignments
ACT

- CASAS
- Carnegie Units
- GED, Revised
- Region XX
- SCANS 2000
- TABE

State Alignments

- Alabama
- Arizona Academic Standards
- California Frameworks
- Canada
- Florida Citizenship Questionnaire

(table continues)

- Florida Applied Technology
- Florida Middle School
- Florida High School
- Florida Sunshine State Standards
- Indiana Competencies
- Indiana Proficiency Guides
- MAP 2000
- Maryland
- Missouri

New Jersey

North Carolina E-O-C

Ohio

Oklahoma PASS

Oregon CIM

Oregon School Reform

South Dakota

TAAS

TEKS

Tennessee

Texas Frameworks

Virginia

(table continues)

Washington

West Virginia

Local Alignments

Kansas City Core Curriculum

St. Louis

Spectrum High School

University of Texas Brownsville

Time-on-task is an important variable in this study, because students can be scheduled for additional hours per week in the CAI reading lab without a major change in scheduling. The Destinations licensing plan allows for unlimited access to the CAI software during the semester in which the student is enrolled, so that students would not have to pay additional fees. Spache (1976) asked, “Is there a maximally effective period of time for successful remediation, or should it be continued indefinitely in the hopes of promoting the greatest possible gain for the student?” (p. 331). Students in the Destinations CAI reading lab are scheduled for 3 hours per week for a semester, but many students do not complete the TASP test during that semester. Some students have registered for several semesters of developmental reading and still not passed the TASP test. Rosenshine is quoted by Chall and Curtis (1992) as having written, "’In general, the more time students spend on activities that are academically relevant and appropriate (in terms of difficulty), the more they achieve’” (p. 268). Chall and Curtis added, “However, children must be provided with opportunities to transfer what they have been taught to "real" reading tasks” (p. 268). Sandrow concluded that the college time schedule works against remedial learning. She is quoted by Costrell (1998): “’Many of our students, especially at the lower levels of remediation, would learn more in a different setting: in smaller groups not subject to the college calendar of only 4 hours a week and a 16-week semester.”

Students enter developmental reading with different abilities and varied needs. According to Spache (1976), it is difficult to determine an optimum schedule for all students.

> A schedule of a certain number of sessions per week is made, students being discharged automatically at the close of the term. This type of arrangement assumes that the same amount (and often type) of instruction suffices for all students, regardless of the nature or degree of their retardation. (p. 356)

It is possible to calculate the amount of gain for a unit of time, but Spache (1976) noted that results are likely to be misleading. We have little idea what amount of gain remedial work should produce in a given time. Is every program that produces almost any gain greater than "normal" maximally effective? Or should we expect remediation to produce two or three times the normal growth?

Some studies described by Spache (1976) led the researchers to conclude that remedial treatment does not affect school progress appreciably over time.

> If sufficiently motivated--and provided socioeconomic support and educational opportunities--these pupils succeed about as well as untreated poor readers or the general population. Some may improve their grades above the levels prior to the treatment, to a level sufficient for graduation eventually; but so do untreated poor readers, it would seem, if they are motivated for school success. (pp. 336-338)

According to Spache, researchers have found little evidence regarding the effectiveness of remedial instruction in terms of the number or length of sessions.

TASP Score Gain

Many of the studies about gain in reading skills use grade-level gain, as shown by the CAI software's measure of grade gain. Such a measure is determined by the skills learned, assuming several skills are learned in one grade and others in the next. This assessment of total student gain is measured on rather low-level thinking skills and should be suspect because the software producers' bias is involved in setting the grade levels (Johnson, 1998).

Many studies of developmental reading use some type of standardized tests such as the Nelson Denny Reading Test, to provide a measure of the pretest to posttest gain. Many of the Texas studies used the TASP gain score as the dependent variable. Other Texas studies used only the TASP posttest score. Goodman (1992) described these studies.

> Most often gain scores on a test, usually a published standardized test, are used to judge the effectiveness of the "treatment." It has become common to argue in support of methods, materials, or techniques by citing evidence from such studies that they "work" (i.e., produce better gain scores than the control treatment). (p. 47)

Goodman explained that such a study is important because it can show that a treatment works, but it cannot lead to conclusions about why the treatment works. Although research does not show that students have greater gains in reading ability by using basal textbooks and materials, public opinion sometimes causes local or state authorities to require that teachers use basal readers in prescribed ways. According to Goodman, "It are difficult to find American school systems willing to replace textbooks completely, particularly basal readers, with trade books and resource materials" (p.62).

Schoener (1990) used gain scores on the Reading and Comprehension subtest of CAT to study the effectiveness of five CAI software programs with students grades 9 through 12. Students in traditional classes (4,565) were compared with students using CAI software (3,287) 1 to 5 days a week in 20- to 50-minute sessions. Mean gains from pretest to posttest on the standardized reading test were significantly higher for students receiving face-to-face instruction. Schoener concluded, "Successful implementation of C.A.I. depends on the capacity of the software to respond to the needs of students and on the teacher's skill in guiding students through the curriculum" (p. 62). A significant notation early in the report divulged that most students were not put into CAI in a way that would allow the software to respond to student needs: "Only 32 percent of the (38) teachers used the initial placement test accompanying the software package" (Schoener, 1990, p. 8).

Boyer (1990) described a study by Ragosta, Holland, and Dean that found that students using the computer only 10 minutes per day raised scores by a significant amount. Increased time on the computer brought an increase in the results.

Boyer (1990) used CAI software and a workbook to give students (Grades 4 and 5) 14 hours of extra reading comprehension experience. Of the 19 students using the computer, 17 increased their reading grade level by more than 1 year. The overall increase showed that the computer group increased 5 months more than the control group, who did not use the computers.

Gender

A study by High (1996) examined at the relationship between the TASP scores and the Assessment of Student Skills for Entry Transfer (ASSET) in 328 academic track students from six community colleges in Texas. The student's age, ethnicity, sex, and other factors were also included as TASP predictor variables in a multiple regression analysis. The reading, writing, and math sections of the test were used. The ASSET test scores were found to be significant predictors of the TASP scores. Age and ethnicity were also good predictors in each area of the exams, but gender added little to the regression model. Reading had the best correlation, with the multiple $\underline{R}$ correlation of 0.58 and $\underline{R}^2$ = 0.33. From the population a random sample of 70 students who needed remediation was chosen and was divided into two groups, those who took remediation and those who did not take the remedial course work. High reported that "students who did not take remedial work ($\underline{x}$ = 227.4) had scores slightly higher than those who took the classes ($\underline{x}$ = 198.2) on the math section of TASP" (p.14). High noted that nothing in the study indicated that more remedial courses would enhance student performance on the TASP test.

High and Low-achievers

A study by Tompkins and Mehring (1986) used a multiple correlation analysis to assess the strength and the relative importance of discrete variables as predictors of competency test scores. The analysis used the Nelson Denny Reading Exam as the dependent variable. The study found that scholastic ability accounted for approximately half of the success or failure on the competency exam. According to Tompkins and Mehring, “Most of this can be attributed to the experience of bright or slow students, for those between the extremes something other than scholastic ability is the primary factor” (p. 27). The analysis also revealed that the social studies ACT scores and English ACT scores were the most powerful predictors, followed by the English I grade. The researchers conclude that this study indicates that what is being measured by the new competency exams is the same type of ability-achievement-aptitude that is measured by other tests.

Contributions of This Study

The present study used correlation and linear multiple regression to evaluate CAI as it is being used by developmental reading students at UTB/TSC. By using this method of evaluation in a regular and systematic way each semester, teachers and administrators may be able to show the effectiveness of small and large changes in the delivery system of CAI. The study can be replicated with other populations and may answer similar questions with other CAI populations.

Summary

A large number of research studies have been published with topics such as “reading effectiveness” and “the success (or failure) of computer-aided instruction.” Venezky (1984) described the available literature on reading instruction, “This collection of over 15,000 books, pamphlets, articles, and occasional records of educational verbosity is an enduring testimony to the patience of the American printer and vulnerability of American forests" (p. 17). Even with this large number of publications, questions still exist about the effectiveness of different methods of reading instruction. Otto (1992) wrote that basic research has a purpose, "but to justify the support of such research under the guise of instructional improvement leads to false expectations and disappointment" (p.12). There exists a need to get beyond the rigors of basic research with two groups and to develop methods that give meaningful results from data that is readily available. The action research method discussed in this paper can provide valuable information to teachers and administrators as changes are implemented each semester.

According to Sticht and McDonald (1992), 40 to 50 % of the adults who enter college have reading abilities at the fifth- through ninth-grade levels. Reading programs must be carefully tailored to the needs of these midlevel literates and to the contexts in which they wish to function because "these students have enough reading skills to begin to read and learn vocational (or other) material in which they are interested" (p. 333).

Many people are concerned that installing CAI reading laboratories will cause schools to purchase unproven technologies at the expense of proven programs. Johnson (1998) believes that "educators have an ethical responsibility to continually examine how we use finite funding to make sure we provide the maximum educational bang for the buck."

This technology evaluation should become an integral part of the evaluation of the total school program. Decision makers must attempt to determine what technology use has contributed to the total program. Using technology to teach basic skills, memorized facts, or low-level thinking skills is expensive for the results received.

> The assessment of this use of technology really has to be an assessment of total student gain of rather low-level skills and is extremely difficult to do for many reasons—Hawthorne effect, bias of software producers who may be conducting the evaluations, lack of resources for controlled study groups, etc. Unfortunately, this technology use seems to be tainting the current attitudes of decision-makers about all uses of technology in schools. (Johnson, 1998)

The methods used for this study are described in Chapter 3.

CHAPTER 3

METHODOLOGY

Introduction

The CAI reading lab at UTB/TSC used the DOS-based PLATO software from Fall 1994 to Spring 1996 and then changed to the Windows 95-based Destinations software by Invest Learning. Destinations software was used for the period of this study, from Summer II 1996 to Spring 1999. The 1st year of CAI involved many computer lock-ups and network crashes. Computer memory problems, network problems, and software glitches kept students from spending as much time with the computer as they should have the 1st year. Results from that year could not be applied to either the next year or the next product.

Cohen and Cohen (1983) explained that practical considerations limit the use of structured research in education, clinical psychology, program evaluation, industrial organization theory, and other fields. Educational researchers seldom are allowed randomly to group students, and they seldom control the variables as required for scientific studies. Some fields such as sociology, economics, political science, and anthropology cannot use such structure at all. “Either the putative causes or effects cannot be produced by investigators . . . or randomization is precluded, or both” (p. 14).

Cohen and Cohen (1983) suggested the analysis of causal models for educational research and explained the methodology:

> The basic strategy of the analysis of causal models is first to state a theory in terms of the variables that are involved and, quite explicitly, of what causes what and what does not, usually aided by causal diagrams. The observational data are then employed to determine whether the causal model is consistent with them, and estimate the strength of the causal parameters. Failure of the model to fit the data results in its falsification, while a good fit allows the model to survive, but not be proven, since other models might provide equal or better fits. (1983, p. 14)

A causal model requires the researcher to have pretest and posttest data, using tests given for that purpose or using test scores collected by the institution in the process of doing business. Cohen and Cohen (1983) described the analysis of data in a causation model: “Causation manifests itself in correlation, and its analysis can only proceed through the systematic analysis of correlation and regression” (p. 15). The causal model used for this study was a pretest/posttest model using Pearson correlation and linear multiple regression to assess the relationship between time-on-task in CAI reading lab and gain in the reading scores of the TASP test. Other variables of interest were used as control variables; and these include gender and high or low pretest scores.

This chapter presents the research design, population, instrumentation, control variables, independent variable, dependent variable, data collection, and data analysis procedures, with a concluding summary.

Research Design

A quantitative study of the relationship between a student's time-on-task in Destinations CAI software and that student's gain on the reading portion of the TASP test will help faculty and students know the effectiveness of the CAI reading lab. Theories were constructed from the literature that CAI reading instruction would be effective in teaching developmental reading students under the following conditions:

1. The more time students spend working with CAI reading instruction (time-on-task), the better they will score on the TASP test. This theory was tested by submitting gain (pretest to posttest) on the TASP test and time-on-task as recorded by Destinations software to statistical correlation and multiple regression tests. Correlation between the two variables indicates the amount of relationship between TASP difference and time-on-task in Destinations software. Multiple regression using TASP difference as the dependent variable and time-on-task as the independent variable indicates the amount of the relationship that was caused by the independent variable, time-on-task.

2. CAI reading instruction providing assessment and developing an individualized course of study for each student helps the student improve the TASP score. Multiple regression allows the development of a regression equation for predicting TASP score gain based on time-on-task in individualized study.

3. Tutorials, application lessons, drill and practice lessons, mastery tests over each skill, and reviews provided by CAI software all help students improve their TASP scores.

Multiple regression allows the development of a regression equation for predicting TASP score gain based on time-on-task in individualized study.

4. Students' enjoyment of CAI reading instruction motivates them to learn more and increase their reading ability. Multiple regression allows the development of a regression equation for predicting TASP score gain based on time-on-task in individualized study.

The research design used for this study was a pretest/posttest model using Pearson correlation and linear multiple regression to assess the relationship between the time-on-task in reading CAI and the gain in reading scores of the TASP test. The model for the study was a single-group study in the form O_1 X O_2 (McMillan, 1996).

The pretest observation O_1 is the TASP reading score for each of the students who took it before beginning CAI instruction. The treatment X is time-on-task in Destinations software. The posttest observation O_2 is the TASP reading score taken after CAI reading lab instruction.

About the one-group model, McMillan (1996) wrote, "The design can be good for studies in which subject effects will not influence the results, such as achievement tests, and when history threats can be reasonably dismissed" (p. 203). The study model and its limitation are described by McMillan.

> A single group of subjects is given a pretest, then the treatment, then the posttest. The results are determined by comparing the pretest score to the posttest score. Although a change from pretest to posttest can be due to the treatment, there are also many possible extraneous factors to be considered. (p. 202)

This model was selected because it will help determine whether the theories proposed are correct. Kamil (1984) called this type of study “descriptive data collection” and explained that, “for educational research, the emphasis is on the description of educational practice, not validation. A goal might be to identify ‘successful’ or ‘non-successful’ instructional components, methods, or environments” (p. 44). According to Kamil, program evaluations, materials development, and classroom procedures are all included in this category. What is important are the relative merits of alternatives rather than explanations, extensions, or validations of theories or models.

Kamil (1984) noted that many correlations or factor analytic and multiple regression studies are found in reading research, even though no causal inferences can be drawn. He emphasized that, although correlation does not logically imply causation, high correlation values do suggest causal relationships. Such suggested relationships have to be verified by other experimental means.

“When regression analyses are used, precise prediction is possible, but causal explanation still does not result” (Kamil, 1984, p. 48). Kamil described the procedure for eliminating possible confounding variables such as experimenter effects and other biases: “This is done by altering the experimental situations and ‘replicating’ the study or experiment under the new conditions. Not only does this assure a higher degree of generalizability but it also narrows the range of possible cause-and-effect relationships” (p. 48).

The four null hypotheses to be tested in this study are stated below:

H_{o1}: Students using Destinations CAI for more time-on-task will not have better score gains on the TASP test than students using Destinations CAI for less time-on-task.

H_{o2}: Females will not make better gains on the TASP test from CAI than males.

H_{o3}: Low-achiever students will not make better gains on the TASP test from CAI than high-achiever students.

H_{o4}: Time-on-task in CAI cannot be used to predict student gain on the reading portion of the TASP test scores.

Population

The population of this study was the population of developmental reading students at UTB/TSC who took the TASP test both before and after CAI intervention. The total of all students who have worked with Destinations CAI during the semesters from Summer II 1996 through Spring 1998 is 2,707 students. But 1,312 of those students never took the TASP exam at all so cannot be used in this study. Another 825 students took the TASP exam only once so did not have TASP pretest and posttest scores. This left a balance of 570 students, but 83 of the remaining students took the TASP exam more than once but did not work with Destinations between the exams. Another 5 students were eliminated because they enrolled in Destinations but did no work in it. These reductions left a total of 482 students with all three factors. Those factors were: (a) pretest TASP score, (b) Destinations time-on-task, and (c) posttest TASP score. The population for this study was

482 students, and the entire population of students used Destinations CAI. The population was not reduced to a sample for this study.

Instrumentation

The pretest measure is the score on the reading portion of the TASP test before CAI instruction. The score on another form of the same exam after CAI instruction is the posttest measure. The TASP difference was calculated by subtracting the raw score of the pretest from the raw score of the posttest.

The reliability estimate for the TASP test is provided by the Kuder-Richardson index of item homogeneity (KR-20), reported in the range of 0.00 to 1.00. The test forms administered in the 1996-1997 school year showed a mean raw score of 25.3-26.8 and a KR-20 reliability of 0.980-0.85 (Texas Academic Skills Program, 1998).

Validity was a major focus during the development process of the TASP test. Committees of Texas higher education faculty developed the skills and item specifications. Skills were validated in surveys of Texas educators and were finalized for testing by the test development committees. Test items were pilot tested in Texas and finalized by the committees based on the pilot test results. Independent panels of college and university faculties reviewed and provided input for use in setting passing standards.

Test items on the reading section of the TASP test include from 36 to 40 items and are based on reading passages adapted from college-level texts and other college-level reading materials (Texas Academic Skills Program, 1998).

Control Variables

Because some studies have shown different results for male and female and for students of different learning levels, these variables were used as control variables. The population was separated into males (N = 167) and females (N = 315) for statistical processing. The population was then separated into high-achievers and low-achievers; that is, students with pretest scores on the TASP above and below the mean. The mean score for all TASP reading pretest scores in the population was 202 points. High-achievers (N = 293) had a score 202 or above. Low-achievers (N = 189) had a score below 202.

Independent Variable

Time-on-task in the CAI software was used as the experimental variable. This variable is recorded by the CAI software and is a measure of time the student spends in tutorials, practice exercises or test-taking in the CAI program. A study of time-on-task in CAI instruction is important to colleges because the time required of students in the CAI reading lab can be changed easily by administrative or faculty decisions. Students could be required to spend 5 hours or 1 hour in the CAI reading lab each week instead of 3. Stricter enforcement of attendance policies could also cause more time-on-task for some students.

Dependent Variable

The dependent variable for this study is the TASP difference. This variable is calculated by subtracting the student's raw score on the pretest (reading portion of the TASP) from the student's raw score on posttest (reading portion of the TASP). The study sought to determine how the TASP difference was affected by the student's time-on-task in Destinations CAI software.

Data Collection

Data were collected from institutional records and did not involve any student intervention. Student population for this study was reduced to exclude students who had never taken the TASP test and students who had taken it only once. Records were researched to assure that one TASP score was earned before the student took CAI instruction, and the other TASP score was earned after CAI instruction.

The data file from the CAI reading lab listed all students enrolled each semester, scores from all TASP tests taken, grade-level at beginning and ending of CAI instruction (as judged by Destinations software), and student time-on-task in Destinations activities. The time-on-task had been averaged to the nearest hour for each semester's work before it was recorded in the student file, so the time-on-task is correct only to the nearest hour. From these records it was possible to determine the number of times the TASP was taken and a grade-level gain according to Destinations software.

UTB/TSC student records provided a list of students enrolled each semester; this list included gender, date of birth, and TASP score for those students who passed the

TASP test. From these records, it was possible to calculate student age at the Fall 1998 semester and number of semesters enrolled.

It was possible to determine from the CAI reading lab records which TASP scores were pretest and posttest scores and time-on-task in the CAI reading lab time between these scores. The total of 2,707 students in the file had to be reduced by 1,312 students who never took the TASP test and 825 students who took the exam only once. Finally, 88 additional students had to be eliminated because they did not work on CAI between the scores. The total eliminated from the population was 2,225 students, and the population left was 482 students. Beginning in Spring 1998, pretest TASP scores are available for all students because TASP regulations were changed to require the TASP test before a student can enroll in college.

Data Analysis Procedures

SPSS for Windows Release 9.0 was used for data analysis, especially descriptive statistics, correlation, and multiple linear regression statistics. The raw data were automatically transformed from Microsoft Excel data files into SPSS data files by the SPSS program.

Summary

This study evaluated the success of computer-aided instruction by using correlation and linear multiple regression to determine the effectiveness of time-on-task in CAI instruction for developmental reading students. Pretest and posttest scores on the TASP test were used in the one-group study. Because CAI is used for large numbers of developmental reading students at UTB/TSC, there is a need to determine the magnitude of the relationship between time-on-task in Destinations CAI and the progress made by developmental reading students. Chapter 4 shows the results found in this study.

CHAPTER 4

FINDINGS

Introduction

A total of 482 students had valid data, and all were used for this study. All variables had available data except age, which was not available for 7 students in the population. A total of 319 students (66.2% of the population) passed the TASP test, and 163 (33.8% of the population) did not pass the TASP test. This chapter presents the findings from the statistical analysis of the data. The discussion of the findings is organized by the four null hypotheses stated in Chapter 1.

Descriptive statistics for the variables of age (mean = 22.4), difference in TASP scores (posttest minus pretest, mean = 29.8), and grade-level gain as indicated by Destinations software (maximum = 11.5) are listed in Table 5. Age scores ranged from 18 to 53. Difference in TASP score had a low of –56 and a high of 132, so there was a wide range in the difference scores.

Descriptive statistics for count of semesters enrolled (mean = 1.9), TASP posttest score (maximum = 281), TASP pretest score (maximum = 254), time-on-task in Destinations activities (mean = 26.5, minimum = 1), and a count of times the TASP test was taken (maximum = 12, mean = 2.9) are also listed in Table 5.

Table 5

Descriptive Statistics for Research Variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age	475	18	53	22.4	4.78
Difference TASP	482	-56	132	29.8	24.56
Grade level gain (Destinations)	482	0	11.5	4.7	2.97
Semesters (count)	482	1	5	1.9	1.02
TASP posttest	482	120	281	231.5	25.91
TASP pretest	482	125	254	201.7	20.06
Time-on-task	482	1	133	26.5	17.87
Times TASP taken	482	2	12	2.9	1.38

Destinations software records indicated that some students in the UTB/TSC study had an 11.5 years grade-level gain as judged by the Destinations software (see Table 5). Additional research into the master files led to a discovery that 43.2% of the students were listed as entering the CAI software at grade level one. Also, for 12.9 % additional students, the entry grade level was listed as “lost”, and these data were calculated as if they were zero. Grade-level gain calculations from this application of the Destinations software should not be trusted because the lost data are calculated as zero.

A scattergram of pretest and posttest scores for the TASP (see Figure 1 in Appendix A) was used to locate outliers that could skew the correlation and multiple regression results. Correlation and multiple regression were used to test the hypotheses of the study. When outlier cases were removed, only small differences resulted in the statistics: Pearson correlation between time-on-task and difference in TASP scores (pretest to posttest) went from -0.045 to -0.030, and $\underline{R}^2$ for the same variables went from 0.002 to 0.001. Other students in the file have large differences between pretest and posttest scores, so the decision was made to keep these cases in the data file.

Null Hypothesis 1

H_{o1}: Students using Destinations CAI for more time-on-task will not have better score gains on the TASP test than students using Destinations CAI for less time-on-task.

SPSS software was used to determine the correlation between the two variables. The correlation results are in Table 6.

Table 6

Pearson Correlation Between Time-on-task and TASP-difference for All Students

Variables	Pearson correlation	Significance (two-tailed)	N
Difference in TASP scores and time-on-task	-.045	.326	482

If this null hypothesis is to be rejected, there must be a significant correlation between the student's time-on-task in Destinations software and the student's gain in TASP score. Instead, a small negative correlation (-0.045) resulted. Correlation between time-on-task in Destinations software and the difference in TASP test scores was low, but regression statistics could provide more information that would help evaluate the success of the Destinations lab. Using TASP-difference as the dependent variable and the time-on-task as the independent variable, linear regression further evaluated the relationship between the variables. Tables 7, 8, and 9 reveal the results from regression statistics.

Table 7 shows the regression statistics for the time-on-task and TASP-difference model. R is the regression coefficient for this model. R = 1 indicates a perfect correlation, and R = 0 indicates that there is no correlation.

Table 7

Regression Model for Time-on-task and TASP-difference for Population

R	R^2	Adjusted R^2	Std. Error of the estimate	R^2 change	F change	Sig. F change
.045	.002	.000	24.5623	.002	.970	.325

Note: df1=1, df2=480; Predictors: (Constant), Time-on-task; Dep. variable: Diff. TASP.

The value of R for this study was 0.045, indicating only a slight correlation. R^2 is an indicator of how well the observations fall on the regression line. If all the observations fall on the regression line, R^2 is 1, but if there is no linear relationship between the dependent and independent variables, R^2 is 0. The R^2 for these variables was 0.002, indicating that only 0.2% of the points fell on the regression line.

Analysis of variance was used to test the hypothesis that there was no linear relationship between the variables. ANOVA is depicted in Table 8. The regression sum of squares indicates how much of the observed variability is attributable to the regression; the residual sum of squares indicates how much of the observed variability is residual, not attributable to the regression.

Table 8

Analysis of Variance of Dependent Variable: Difference in TASP Scores

Model unit	Sum of squares	Df	Mean square	F	Sig.
Regression	585.309	1	585.309	.970	.325
Residual	289586.02	480	603.304		
Total	29017171.33	481			

Table 8 shows that only a small portion of the variability in the difference in TASP scores was attributable to the regression. (Regression sum of squares was 585.309, but the residual sum of squares was 289,586.02, indicating that most of the observed variability was from the residual.)

The F statistic is a calculation of the mean square regression divided by the mean square residual, and it serves to test how well the regression model fits the data. If the probability associated with the F statistic is small, the hypothesis that $R^2_{pop} = 0.000$ is rejected. In this study the F statistic was less than 1, indicating that the regression line calculated was not a good predictor for this population. Table 9 gives the calculated values for the regression equation coefficients.

Table 9

Regression Coefficients for Dependent Variable: TASP-difference

Model	B	Std. error	Beta	T	Sig.
(Constant)	31.483	2.005		15.702	.000
Time-on-task	-0.06174	.063	-.045	-.985	.325

The standard multiple regression equation for a single independent variable is $Y_i = \beta_o + \beta_1 X_i + e_i$ so the equation of the regression line for this data file was $Y_i = 31.483 - 0.06174X_i$. In this equation Y_i was the dependent variable (difference in TASP scores), and X_i is the independent variable (time-on-task in Destinations software). The error term e_i is the difference between the observed value of Y_i and the subpopulation mean at the point X_i. The error is assumed to be normally distributed, independent, random variables with a mean of 0 and a variance of $\underline{\sigma}$. Figure 2, showing the regression line for the variables difference in TASP scores and time-on-task in Destinations software, can be found in Appendix C.

Because more than 90% of these students are Hispanic, an exploration of race as a factor was not feasible. Additional variables considered were the number of times the student took the TASP test, the grade level gain as indicated by Destinations software, the number of semesters the student was enrolled, and the TASP pretest score. Other possible independent variables considered in the literature are age, gender, and race. Results from these and other variables are listed in Table 10. Only the number of semesters enrolled was found to have a significant correlation with the difference in TASP scores. This correlation was significant, but it was negative (-0.209).

Table 10

Correlation Between Time-on-task and Other Independent Variables for Population

Variables	Pearson correlation	Significance (2-tailed)	N
Age and difference in TASP	-.025	.582	475
Gender and difference in TASP	.084	.065	482
Times TASP taken and difference in TASP	-.026	.572	482
Gain on Dest. and Difference in TASP	-.066	.151	482
Semesters enrolled and Difference in TASP	-.209*	.000	482

Note: * Indicates correlation is significant at the 0.01 level (two-tailed).

Only the number of semesters enrolled was found to have a significant correlation with the difference in TASP scores. This correlation was significant, but it was negative (-0.209).

The Pearson correlation for this relationship between time-on-task and the TASP-difference for the population of 482 students was -0.045, indicating a weak correlation in a negative direction. The regression coefficient was 0.045, verifying the weak correlation. The equation for the multiple regression line was:

TASP-difference = 31.483 - 0.06174 time-on-task.

The line's negative slope and low ANOVA Significant F value (0.970 - less than one) make it impossible to reject the null hypothesis. Students using Destinations CAI for more time-on-task will not have better score gains on the TASP test than will students using Destinations CAI for less time-on-task.

Null Hypothesis 2

H_{o2}: Females will not make better gains on the TASP test from time-on-task in CAI than males.

Some studies show that females gained more in CAI than did males. Although overall gain from Destinations CAI was minimal, there may be a difference between the relative successes of females and males. Table 11 lists correlation and regression coefficients (between time-on-task in Destinations software and TASP-difference) for the females and the males in the population.

Table 11

A Comparison of the Correlation and Regression Coefficients by Gender

Gender	N	Pearson correlation	R	R^2	F
Female	315	.111*	.111	.012	3.893
Male	167	-.290*	.290	-.084	15.198

Note: * Correlation is significant at the 0.05 level (two-tailed).

For this population, there was a clear difference between the relative success of females and males. Females had a low positive correlation between time-on-task in CAI and difference in the TASP tests (pretest to posttest). The score was significant at the 0.05 level (two-tailed). Males had a stronger correlation, but it was negative, indicating that the more time they spent in CAI the worse their TASP score difference would be. Their correlation was also significant, reaching the 0.01 level (two-tailed). The regression correlation for females was 0.247 and for males, 0.290.

Figures 3 and 4, depicting regression correlation lines for time-on-task in Destinations software and difference in TASP test scores for females and males, are included in Appendix D. These figures illustrate the differences between the way females and males respond to CAI instruction. Table 12 lists the regression coefficients for female and male students in this population.

Table 12

Regression Coefficients for Dependent Variable - Female and Male

Gender	B	Std. error	Beta	T	Sig.
Female					
(Constant)	24.219	2.480		9.767	.000
Time-on-task	.150	.076	.111	1.973	.049
Male					
(Constant)	42.801	3.227		13.264	.000
Time-on-task	-.410	.105	-.290	-3.899	.000

Beta values from Table 12 are 0.111 for females and -0.290 for males. Because the beta value is the slope of the regression line, females had a slightly positive benefit from time-on-task in Destinations software. Males had a negative benefit from time-on-task in Destinations software since the slope was negative. The slope for the males had a magnitude more than two times as great as the slope for females. These results are graphically depicted in the Appendix D curve estimation plots (Figures 3 and 4).

The equation for the multiple regression line for females was TASP-difference = 3.743 + 0.04119 time-on-task. The line for males was TASP-difference = 42.801 - 0.410 time-on-task. Female ANOVA Significant $\underline{F}$ is 20.421 and male ANOVA Significant $\underline{F}$ was 15.198. Both are reasonably high and have significance greater than 0.001, so the null hypothesis is rejected, and females do make better gains on the TASP test from CAI than males (2) H_0: $O_F > O_{M.}$

The statistical means of several variables are interesting. The average female was 1.15 years older, enrolled for more semesters, took the TASP more often, spent nearly 3 hours more time-on-task, and had higher TASP pretest scores. Males had a higher gain on TASP posttest and a greater difference in TASP scores pretest to posttest.

Null Hypothesis 3

H_{o3}: Low-achiever students will not make better gains on the TASP test from time-on-task in CAI than high-achiever students.

Table 13 shows some of the descriptive statistics for low-achievers and high-achievers. Low-achiever students did indeed make better gains on the TASP than high-achiever students.

Table 13

Statistical Mean for Low and High-achievers

Variable	Low-achievers	High-achievers
Time-on-task	28.4180	25.3413
Difference TASP	38.1905	24.4608
Age	23.1892	21.8586
Gain on Destinations	4.5989	4.8126
Semesters enrolled	1.9683	1.8635
Times TASP taken	2.9947	2.7952
TASP posttest	219.7884	239.0683

The Pearson correlation for the relationship between time-on-task and the TASP-difference for the 189 low-achiever students (below mean on pretest score) was -0.068 and for the 293 high-achiever students (above mean on pretest score) was -0.074. These correlations are both weak and negative. The regression coefficient for low-achievers was 0.068 and for high-achievers was 0.074. The $\underline{R}^2$ value for low-achievers was 0.005 and for high-achievers was 0.006, so less than 1% of the students can be predicted by these equations.

Regression coefficients are listed in Table 14. Equations for low-achievers and high-achievers have a slight negative slope, indicated by the B coefficients for time-on-task.

Table 14

Regression Coefficients for Dependent Variable - Low and High-achievers

Gender	B	Std. Error	Beta	T	Sig.
Low-achievers					
(Constant)	40.948	3.593		11.396	.000
Time-on-task	-0.09703	.104	-.068	-.930	.354
High-achievers					
(Constant)	26.775	2.177		12.300	.000
Time-on-task	-0.09132	.072	-.074	-1.271	.205

For low-achievers the slope was -0.0970, and for high-achievers the slope was -0.0913. The equation for the multiple regression line for low-achievers was TASP-difference = 40.948 - 0.09703 time-on-task, and the line for high-achievers was TASP-difference = 26.775 - 0.09132 time-on-task. Low-achiever ANOVA Significant F was 0.865 and high-achiever ANOVA Significant F was 1.616. Both were low, so research fails to reject the null hypothesis. Low-achiever students will not make better gains on the TASP from time-on-task in CAI than high-achiever students (3) H_0: $O_L <= O_{H.}$

Null Hypothesis 4

H_{o4}: Time-on-task in CAI cannot be used to predict student gain on the reading portion of the TASP test scores.

Every calculation of Pearson correlation and multiple regression correlation indicates that time-on-task in Destinations software as it is presently being used at UTB/TSC does not significantly help students increase their reading scores on the TASP test. Each regression equation calculated had a negative or a small positive slope, indicating that there was little relationship between gain on TASP reading scores resulting from time-on-task in Destinations software.

Equations for each of these relationships have been developed, but the equation of the entire population had an adjusted $\underline{R}^2$ value of 0.000; for high-achievers the equation had an adjusted $\underline{R}^2$ value of 0.002 and the low-achievers had an adjusted $\underline{R}^2$ value of 0.001. These low adjusted $\underline{R}^2$ values indicate that the equations do not fit the population, so the equations do not allow time-on-task to predict any TASP-difference scores for the population. It was not possible to reject the null hypotheses for these equations.

The equations for females and males do predict scores for a small part of the population. The adjusted $\underline{R}^2$ for females was 0.058, indicating that about 6% of the population fit the equation. The adjusted $\underline{R}^2$ for males was 0.079, indicating that about 8% of the population fit the equation. Since the male correlation was negative, the equation for males will not be helpful. It indicates that the more time-on-task the males have, the less improvement they will have on the TASP scores. Except for the females, the null hypothesis was accepted. The regression equations cannot be used to predict the success of these students on increasing their TASP scores. Time-on-task in Destinations CAI as it was used at UTB/TSC cannot be used to predict gain on TASP test scores.

CHAPTER 5

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

Developmental reading is a state-mandated course of study, and it is a required class for large numbers of college students. Since 1994, UTB/TSC has been using CAI in an effort to improve the success of students and also to lower the costs of developmental reading courses (Developmental Reading Program 1995). Although the CAI reading lab was established as a requirement for every developmental reading student, evaluation of the effectiveness of CAI has been inconclusive. Even after a new computer-directed instruction program, Destinations, was installed in 1996, there has been no effective way to evaluate the CAI instruction.

Boylan's (1996) study, conducted under the direction of the Texas Higher Education Coordinating Board, found that many remedial courses in Texas colleges were "below professional standards". The study determined that the quality of remedial courses provided in support of the TASP varied widely and that these courses needed ongoing and systematic evaluation. Site visits to public schools by the National Center for Developmental Education led researchers to conclude that remedial/developmental education courses and activities in Texas are rarely evaluated in a consistent and systematic fashion (Boylan, 1996). This study investigated a pretest-posttest evaluation method that permits regular and systematic evaluation of CAI by allowing the researcher to use data from pretests and posttests already given in most schools and colleges. If a high correlation exists between the gain in test scores (pretest to posttest) and the time-on-task in CAI study, this high correlation will indicate a strong relationship between the two variables.

Correlation does not mean "causation," but if there was no correlation between two variables, there was no causation. When multiple regression correlation is added to the evaluation methodology, it is possible to identify, isolate, or nullify variance in a dependent variable that is presumably caused by an extraneous independent variable.

The problem researched in this study was to determine the relationship between time-on-task in Destinations software and the progress in reading abilities of developmental reading students (as indicated by the reading portion of the TASP tests). The one-group evaluation, using pretest and posttest data, can be used regularly and systematically to evaluate the success of CAI software. Regular evaluation will allow administrators to determine whether or not software changes and upgrades, tutors, scheduling methods, and other factors are effective.

Methodology

In this study null hypotheses were tested by using the results from descriptive statistics, Pearson correlation, and linear multiple regression. In this one-group study, the pretest score from the TASP test (O_1) was subtracted from that student's posttest score on the TASP (O_2). This TASP-difference served as the dependent variable (DV), and the student's time-on-task, as recorded by Destinations CAI software, served as the independent variable (IV). The Pearson correlation between the DV and IV enabled the researcher to determine the strength of the relationship between the variables. These same data variables were compared using linear regression correlation. Regression statistics provide a causal model that allows additional analysis of the relationship, including calculating the slope of the regression line and developing an equation for the line. If the correlation between the variables is strong, this equation will predict the dependent variable for other members of the population. The regression calculations produce a student's t distribution with N - 2 degrees of freedom and a Significant F value, both of which were used to quantify the effectiveness of the equation for predicting the population.

In this study several other independent variables were also tested for correlation and linear regression. Multiple regression was able to partial out the effects of other variables so that the researcher knew mathematically what part of the statistical model was determined by each variable. Multiple regression can also be used to provide an equation for regression line of complex relationships involving many variables. Each variable, and its part in the equation, is represented by the beta weight for that variable in the general equation

$$Y_i = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + ... + \beta_n + e.$$

The strength of each beta weight (β_1, β_2, β_3, … and β_n) is indicated by the R^2 measure of the goodness of fit of the observations. If $R^2 = 1$, all the observations fall on the regression line. If $R^2 = 0$, there is no linear relationship between the variables. Each of the null hypotheses is listed, and the findings for that hypothesis are described in the following sections.

Null Hypothesis 1

H_{o1}: Students using Destinations CAI for more time-on-task will not have better score gains on the TASP test than students using Destinations CAI for less time-on-task.

Instead of finding a strong relationship between a student's time-on-task in Destinations courseware and his/her improvement on the TASP test, both correlation and linear regression calculations showed little or no relationship between the two variables. Failure to reject the null hypothesis leads to the conclusion that, for this population, students using Destinations CAI for more time-on-task are not likely to have better score gains on the TASP test than students using Destinations CAI for less time-on-task.

Some of the literature supported the idea that more time-on-task would lead to better scores, and some did not. CAI programs provide skills-based training after testing to determine which skills the student does not have. Spache (1976) wrote that training in specific skills has been shown to be successful for developmental students, but advised that "we must constantly observe the pupil's behavior, responses to the approach we are using, and its apparent impact upon his development" (p. 9). Because only one reading teacher was involved in the CAI instruction lab, it may not be possible for that person to observe and react to as many as 900 developmental students in a semester.

The basal reading system of reading instruction fits easily into CAI programs because it is highly structured and it emphasizes word analysis skills. However, Nurss and Hough (1992) observed that good comprehension does not always follow from good word analysis skills. Balajthy (1989) warned that most college reading courses do not last long enough for any substantive vocabulary improvement. According to him, reading instruction for older students has two important principles:

1. Curriculum should stress the process and tools of learning instead of subskill rules about reading.

2. The curriculum must closely match and augment the student's content curricula. These principles may not be provided by Destinations CAI instruction, although their literature describes the lessons as designed especially for adult and adolescent learners.

Although many studies found CAI to be beneficial for students, most of them did not use CAI without classroom instruction (Boyer, 1990; Seaman & McCallister, 1988; Williams, 1993). But Seaman and McCallister warned that "the more effective CAI systems are those that are integrated with traditional teacher/student instruction" (p. 5).

Schoener (1990) found that students who received face-to-face instruction made gains that were significantly higher than students in CAI only. Boylan and Saxon (1998a) suggested that CAI as a supplement to classroom instruction may be beneficial, but they warned, "Research has consistently shown that using computers as the primary means of instructional delivery is not effective for developmental students."

One additional factor to remember is that the TASP test has only 36-40 questions and covers only six areas. Destination consists of a large number of skills, and many of these skills are not tested by the TASP test. Students may be learning useful skills through CAI, but most of those skills do not show up on the retaking of the TASP. Destinations can be aligned to most assessment instruments (see Table 4) and has even been aligned to the special needs of the University of Texas at Brownsville. Perhaps UTB/TSC needs to reconsider this sequence of activities.

Since more than one half of the students in Destinations were listed as starting CAI at grade-level 1 or zero, perhaps UTB/TSC is not making proper use of the assessment tests given by Destinations. If students are not entering Destinations at the proper lever, much of their work may be nonproductive busy work. There is even the chance that students have purposely missed questions on the assessment test to finish more quickly or so that their lessons are easier.

Changing to another CAI software program may not solve the problems. Efforts should be made first to enhance students' time-on-task and then to ensure that students spend as much time in CAI software as possible. Schoener (1990) found that gains were higher for students who received some face-to-face instruction. Perhaps the teacher (director) of developmental reading needs to be more available to the students and more involved with them. Perhaps some combination of class work and CAI will meet the needs of more students.

Some recommendations for UTB/TSC and other schools using computer-aided instruction for developmental education follow:

1. Perform complete evaluations of CAI each semester. Plan for pretest and posttest scores from each student.

2. Be sure that the students know the importance of the assessment tests in CAI and that they have ample time to complete them.

3. Develop some methods for personal involvement with the students, even some class time if necessary.

4. Carefully align CAI instruction to the skills required on the TASP test.

5. Make effective use of weekly progress reports available from Destinations software.

6. Carefully monitor students during lab time to ensure that they make the best use of the lab time.

7. Carefully monitor student attendance and time-on-task.

Null Hypothesis 2

H_{o2}: Females will not make better gains on the TASP test from time-on-task in CAI than males.

Although correlations between time-on-task in CAI and difference on the TASP test are low for both female and male, both are significant to at least the 0.05 level. There was a moderate difference because the correlation was negative for the male and positive for the female. Both have significance greater than 0.01, so the null hypothesis was rejected. Females in this study did make better gains on the TASP test from time-on-task in CAI than males. Researchers should conduct additional research to determine the cause for this difference. Statistical means for several variables may provide some clues. The average female was 1.15 years older, enrolled for more semesters of developmental reading, took the TASP test more often, spent nearly 3 hours more time-on-task, and had higher TASP pretest scores. Males had a higher gain on TASP posttest and greater difference in TASP scores pretest to posttest.

A study by High (1996) indicated that gender was not significant in developing a regression model for student success on the TASP. Perhaps age or other factors not used in this study would provide the reason for this difference. Perhaps males do not like sitting in front of the computer as much as females. Perhaps they dislike taking a reading course, especially developmental reading.

A study by Salerno (1995) randomly looked at at-risk fifth graders in one group using 60 extra minutes per week in CAI and another group using 60 extra minutes per week in special workbooks. Both groups had better achievement than the control group without extra time, but boys using CAI had significantly better achievement than did boys using workbooks. Girls using CAI had only slightly better achievement than did girls using workbooks. This study showed a difference between gender similar to the current study, but male and female results were reversed.

Most students entering college developmental reading are adult midlevel literates with reading levels between Grades 5 to 9, according to Sticht and McDonald (1992). They advised, “Reading programs must be carefully tailored to the needs of these midlevel literates and to the contexts in which they wish to function” (p. 326).

Sticht and Mcdonald (1992) further recommended that midlevel literates will learn to read as they are exposed to materials in which they are interested. “Both content knowledge and reading skills contribute to students’ ability to learn more about their field of interest” (p. 333). CAI reading activities may not be interesting to adult males because the reading materials are not from their areas of interest.

Some recommendations for UTB/TSC and other schools using computer-aided instruction for developmental education follow:

1. Tabulate responses on the student questionnaire separately for male and female to see whether or not there are gender differences in how students feel about the CAI lab.

2. Conduct additional research to determine why males had negative correlations between time-on-task in the CAI reading lab and difference in TASP scores, pretest to posttest.

3. Conduct additional research to determine why females had positive correlations between time-on-task in the CAI reading lab and difference in TASP scores, pretest to posttest.

4. Make a concerted effort to insert reading materials from content areas of interest to adult males and adult females. CAI has the ability to respond to student choices, and software programs should be written so that students can select their own reading materials.

5. Make the developmantal reading CAI lab a more interesting environment for male students.

Null Hypothesis 3

H_{o3}: Low-achiever students will not make better gains on the TASP test from time-on-task in CAI than high-achiever students.

Low-achiever and high-achiever ANOVA Significant F were both low, so the research fails to reject the null hypothesis. Low-achiever students will not make better gains on the TASP from time-on-task in CAI than high-achiever students. Students with pretest TASP scores below 202 had approximately the same correlation between time-on-task in the CAI reading lab and difference in their TASP scores as students who scored above 202 on the pretest TASP. Both correlations were small and negative.

A study by Tompkins and Mehring (1986) found that scholastic ability accounted for approximately half of the success or failure on the competency exam. The present study did not find that difference, perhaps because all students were developmental students.

Nurss and Hough (1992) described a study using "think-aloud strategies" with college-level students to reveal that students with lower grades did not use an integration strategy. "They relied on personal information to understand the text, used a reflexive (personal) rather than an entensive (textual) mode of responding, and failed to relate information within the text in an integrated fashion" (p. 302). CAI instruction needs to train low-level students

Scholastic ability, according to Tompkins and Mehring (1986), accounts for approximately half of a student's success or failure on competency exams. Part of the TASP-difference can be attributed to the difference between high-achiever students and low-achiever students. It may be useful to isolate students in the central part of the distribution and to repeat the study, looking for difference between the high-achievers and low-achievers. Spache (1976) warned that, for the lowest achievers, regression toward the mean will increase the posttest scores, and, for the highest achievers, regression toward the mean will decrease the posttest scores. This could create the impression that the worst of the poor readers made the greatest gains.

Recommendations for UTB/TSC and other schools using computer-aided instruction for developmental education follow:

1. Continue studies of low-achievers and high-achievers with different developmental reading populations to see whether these results are the same with other populations.

2. Explore other groupings of high and low-achievers to determine whether more of the TASP difference is from pretest ability

3. Look for other differences between the high-achiever and low-achiever students.

Null Hypothesis 4

H_{o4}: Time-on-task in CAI cannot be used to predict student gain on the reading portion of the TASP test scores.

Equations for each of these relationships have been developed, but the low adjusted $\underline{R}^2$ values indicate that the equations do not predict values for the population. Except for the male and female calculations, the statistics failed to reject the null hypothesis. The regression equations cannot be used to predict the success of these students in increasing their TASP scores. Time-on-task in Destinations CAI as it is used at UTB/TSC cannot be used to predict gain on TASP test scores.

The equations for females and males did predict scores for a small part of the population. The negative correlation for males indicates that, the more time-on-task the males have, the less improvement they will have on TASP scores. Results from the gender calculations are important because they show that some students are benefiting from time-on-task and some are not. Whether the reason was due to gender or another unknown division, this difference is significant. Are there reasons why females enjoy CAI more than males? Do they perhaps work harder?

Since most CAI programs follow the basal learning system, reading selections are limited by the overly simple, "grade-level" vocabulary. Readings are "low in interest and low in literary value. As a result, students, especially beginning readers may find the selections so unappealing thay are not motivated to read actively" (Whitaker et al., 1989, p. 13.

Whitaker et al. (1989) also noted that, when CAI fails to improve learning, it is because the software is not increasing academic learning time. Students are working on activities that do not help them learn to read. Balajthy (1989) wrote,

> The low-level "skill-and-drill" approach used in most of the existing software simply does not prepare students for analysis and synthesis needed to deal with content-area tests, especially at the college level, nor does it teach effective learning strategies. (p. 18)

According to Balajthy, educators can be tempted to use computers primarily as electronic workbooks. Developmental classes can be assigned to drill work that is based on outdated learning and comprehension theories "from more than 20 years ago" (p. 19).

Developmental reading departments need to plan CAI reading activities that have been shown by research to be effective. The research needs to be replicated with each new population and with any changes in instructional methods or software. Calfee and Pointkowski (1984) suggested correlation and factor analytic techniques to evaluate instruction, adding, "It is difficult for us to imagine a well-planned investigation that does not bring into play all these methods, and others" (p. 89).

Using correlation and linear regression, it is possible to quantify results from small changes in CAI instruction. Any semester when correlation or regression correlation numbers increase, the changes that were made in instruction may be a reason. Small changes can be further tested, using random grouping without disrupting lab work. Quasi-experimental grouping can be used for additional studies. For instance, additional tutors can be provided at certain times of the day, and results from students scheduled for those hours can be compared with results from other students.

Some recommendations for UTB/TSC and other schools using computer-aided instruction for developmental education follow:

1. Regular evaluation can be used to measure the success or failure of events and activities affecting CAI.

2. Small changes in CAI instruction should be tested using quantitative means.

3. Students can be encouraged to spend more time-on-task if statistics can show that a predictive equation applies.

Limitations

Only a small portion of the actual developmental student population could be used in this study because so many students took the TASP only once or did not take it at all. If these students had been given another test so that they could have had a pretest and a posttest, perhaps the results would have been different for the entire population of developmental students. The TASP test is now (beginning in 1998) required of all students entering Texas colleges before any courses can be taken, so TASP can be used as pretest and posttest in the future. Conclusions about time-on-task in Destinations courseware apply to these students during this time only.

Changes need to be made in the CAI reading lab to make it more effective, but one application of this study does not tell administrators what needs to be done. This study needs to be replicated regularly at this location and at other locations.

Recommendations for Further Studies

1. Include all students in pretests and posttests. Schedule the pretests and posttests at the beginning and end of each semester.

2. The collecting of data and testing of the quality of educational activities should not wait for the possibility of a two-group study. Decisions about computer-aided instruction should not be made on the basis of cost, convenience, or ease of use, but on the basis of proven success.

3. Repeat this study with each new population or each change in methods or software. A regular and systematic evaluation using pretest and posttest data will provide

benchmarks so that the value of changes can be measured.

4. The use of this method of research provides some answers, but it also helps clarify questions that should be answered through further research.

5. Use additional research methods to provide answers to questions clarified by correlation and multiple regression.

6. The variables time-on-task, gender, age, type of school, previous academic achievement, and standardized tests need further clarification in the evaluations of CAI instruction.

APPENDIX A

TASP PRETEST AND TASP POSTTEST

USED TO LOCATE OUTLIERS

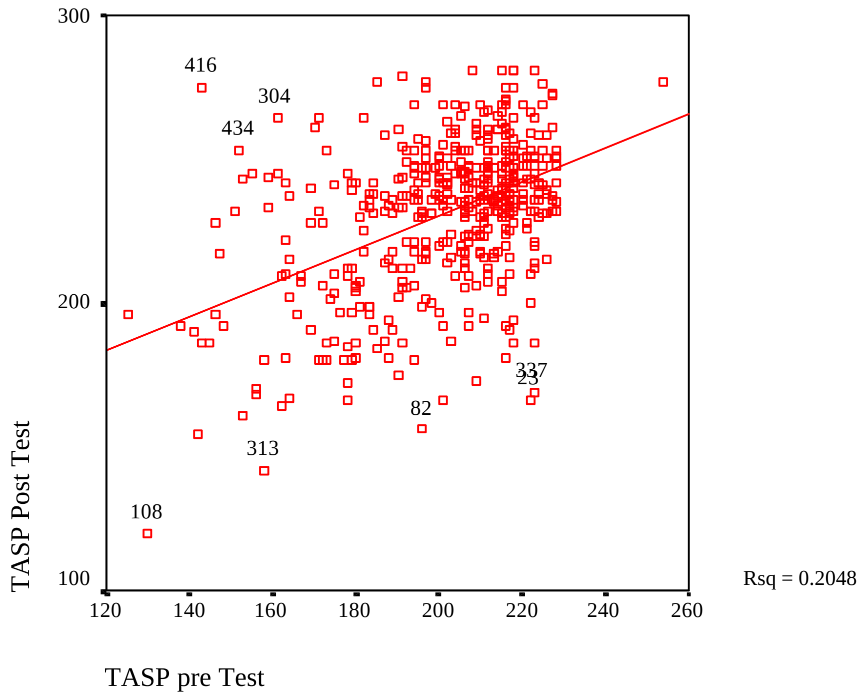

Figure 1. TASP pretest and TASP posttest used to locate outliers. $\underline{R}^2$ for this data is 0.2048. After outliers are removed $\underline{R}^2$ for the data is 0.2285.

APPENDIX B

DATA FILE

DATA FILE

Semest	Sems	Sex	Age	# tasp	Asset	Gain dest	Pass tasp	Post O_2	Time	Pre O_1	Diff tasp
983s2	1.0	1.0	.	2.0		1.0	232.0	232.0	30.0	202.0	30.0
983s2	2.0	1.0	.	2.0		2.0	.	228.0	40.0	172.0	56.0
963su2	5.0	.0	20.0	2.0	36	10.0	.	191.0	24.0	184.0	7.0
963su2	5.0	.0	21.0	2.0	36	7.50	.	212.0	104.0	189.0	23.0
963su2	4.0	.0	23.0	6.0		5.0	.	192.0	10.0	201.0	-9.0
963su2	5.0	.0	20.0	4.0	34	5.0	236.0	236.0	37.0	216.0	20.0
963su2	1.0	.0	21.0	3.0	35	10.0	243.0	243.0	22.0	222.0	21.0
963su2	2.0	.0	21.0	4.0	33	6.50	231.0	231.0	47.0	198.0	33.0
963su2	1.0	.0	22.0	4.0	45	3.0	269.0	248.0	25.0	212.0	36.0
963su2	3.0	.0	23.0	7.0		4.50	253.0	253.0	68.0	192.0	61.0
963su2	5.0	.0	25.0	12.0		5.50	235.0	235.0	70.0	206.0	29.0
963su2	2.0	1.0	22.0	5.0		1.20	.	192.0	15.0	216.0	-24.0
963su2	3.0	1.0	24.0	3.0		3.50	.	172.0	26.0	178.0	-6.0
963su2	4.0	1.0	22.0	2.0	31	2.0	230.0	230.0	22.0	224.0	6.0
963su2	2.0	1.0	22.0	2.0	41	5.50	238.0	238.0	15.0	202.0	36.0
963su2	1.0	1.0	22.0	2.0		1.0	269.0	269.0	17.0	204.0	65.0
963su2	1.0	1.0	23.0	5.0		1.0	232.0	232.0	11.0	217.0	15.0
964fa	2.0	.0	19.0	3.0	33	6.0	.	180.0	12.0	171.0	9.0
964fa	2.0	.0	19.0	2.0	34	6.0	.	184.0	48.0	185.0	-1.0
964fa	2.0	.0	19.0	4.0		7.0	.	180.0	24.0	172.0	8.0
964fa	4.0	.0	19.0	2.0	35	7.0	.	166.0	24.0	222.0	-56.0
964fa	1.0	.0	19.0	2.0		4.0	250.0	250.0	14.0	220.0	30.0
964fa	1.0	.0	19.0	2.0		5.50	253.0	253.0	30.0	218.0	35.0
964fa	2.0	.0	19.0	2.0	37	10.50	232.0	232.0	10.0	222.0	10.0
964fa	4.0	.0	20.0	4.0		5.0	.	207.0	63.0	167.0	40.0
964fa	1.0	.0	20.0	2.0	37	1.80	.	197.0	13.0	207.0	-10.0
964fa	2.0	.0	20.0	2.0	36	6.0	.	228.0	27.0	211.0	17.0
964fa	3.0	.0	20.0	3.0	32	2.0	.	180.0	19.0	194.0	-14.0
964fa	2.0	.0	20.0	2.0		6.0	.	191.0	26.0	189.0	2.0
964fa	1.0	.0	20.0	2.0		8.50	.	192.0	12.0	207.0	-15.0
964fa	1.0	.0	20.0	2.0	41	7.0	253.0	253.0	26.0	225.0	28.0
964fa	1.0	.0	20.0	2.0	41	7.50	244.0	244.0	32.0	202.0	42.0
964fa	3.0	.0	21.0	2.0	34	6.0	.	186.0	19.0	223.0	-37.0

Semest	Sems	Sex	Age	# tasp	Asset	Gain dest	Pass tasp	Post O_2	Time	Pre O_1	Diff tasp
964fa	2.0	.0	21.0	4.0		3.40	.	173.0	22.0	209.0	-36.0
964fa	1.0	.0	20.0	3.0	37	7.0	236.0	236.0	32.0	224.0	12.0
964fa	2.0	.0	21.0	5.0		4.40	.	168.0	14.0	156.0	12.0
964fa	2.0	.0	21.0	2.0	32	5.50	.	192.0	46.0	138.0	54.0
964fa	2.0	.0	21.0	2.0	41	2.50	.	217.0	34.0	213.0	4.0
964fa	3.0	.0	21.0	4.0		7.0	.	225.0	41.0	217.0	8.0
964fa	2.0	.0	21.0	2.0	32	8.0	.	180.0	30.0	173.0	7.0
964fa	4.0	.0	21.0	2.0	31	10.50	.	170.0	82.0	156.0	14.0
964fa	2.0	.0	22.0	4.0	30	7.0	.	220.0	25.0	223.0	-3.0
964fa	3.0	.0	22.0	2.0	30	6.0	.	209.0	21.0	207.0	2.0
964fa	1.0	.0	22.0	2.0	34	1.0	.	212.0	1.0	193.0	19.0
964fa	1.0	.0	22.0	2.0		2.0	.	196.0	19.0	125.0	71.0
964fa	2.0	.0	22.0	2.0	35	.50	.	156.0	30.0	196.0	-40.0
964fa	2.0	.0	23.0	2.0	31	3.0	.	199.0	27.0	183.0	16.0
964fa	3.0	.0	23.0	3.0		10.50	.	204.0	37.0	215.0	-11.0
964fa	3.0	.0	23.0	5.0		7.0	231.0	231.0	62.0	196.0	35.0
964fa	3.0	.0	23.0	4.0		5.50	.	212.0	17.0	206.0	6.0
964fa	1.0	.0	23.0	2.0		8.0	.	212.0	12.0	179.0	33.0
964fa	2.0	.0	24.0	3.0		2.0	.	181.0	10.0	180.0	1.0
964fa	3.0	.0	24.0	2.0	34	6.0	.	167.0	43.0	164.0	3.0
964fa	1.0	.0	24.0	3.0		2.0	.	218.0	32.0	189.0	29.0
964fa	3.0	.0	25.0	2.0		5.50	.	221.0	45.0	194.0	27.0
964fa	4.0	.0	25.0	2.0	34	9.50	.	201.0	18.0	174.0	27.0
964fa	1.0	.0	39.0	3.0		8.0	.	195.0	23.0	211.0	-16.0
964fa	4.0	.0	19.0	2.0	37	7.0	253.0	253.0	21.0	216.0	37.0
964fa	1.0	.0	20.0	3.0	33	6.0	236.0	236.0	16.0	217.0	19.0
964fa	3.0	.0	20.0	3.0	40	10.50	230.0	230.0	6.0	216.0	14.0
964fa	2.0	.0	20.0	3.0	40	7.50	247.0	247.0	47.0	194.0	53.0
964fa	2.0	.0	20.0	2.0	30	9.50	275.0	275.0	30.0	216.0	59.0
964fa	2.0	.0	20.0	3.0	31	10.50	269.0	269.0	13.0	201.0	68.0
964fa	1.0	.0	20.0	2.0	37	7.0	231.0	231.0	24.0	225.0	6.0
964fa	3.0	.0	20.0	3.0	35	7.0	247.0	247.0	62.0	211.0	36.0
964fa	3.0	.0	20.0	2.0		2.30	250.0	250.0	13.0	223.0	27.0
964fa	1.0	.0	20.0	2.0	40	7.0	276.0	276.0	21.0	225.0	51.0
964fa	3.0	.0	20.0	2.0	33	6.0	247.0	247.0	52.0	217.0	30.0
964fa	2.0	.0	20.0	2.0	40	1.0	269.0	269.0	12.0	216.0	53.0
964fa	1.0	.0	20.0	2.0		7.0	242.0	242.0	20.0	224.0	18.0
964fa	1.0	.0	20.0	2.0	37	.40	242.0	242.0	2.0	184.0	58.0
964fa	2.0	.0	20.0	3.0	36	7.0	242.0	242.0	42.0	208.0	34.0
964fa	1.0	.0	20.0	2.0	33	6.0	236.0	236.0	31.0	216.0	20.0
964fa	2.0	.0	20.0	2.0		6.0	235.0	235.0	22.0	209.0	26.0

Semest	Sems	Sex	Age	# tasp	Asset	Gain dest	Pass tasp	Post O_2	Time	Pre O_1	Diff tasp
964fa	1.0	.0	20.0	2.0	35	7.0	232.0	232.0	27.0	206.0	26.0
964fa	1.0	.0	20.0	2.0	39	1.50	231.0	231.0	6.0	217.0	14.0
964fa	1.0	.0	20.0	2.0	37	6.0	235.0	235.0	21.0	213.0	22.0
964fa	1.0	.0	20.0	2.0		3.40	261.0	261.0	1.0	227.0	34.0
964fa	1.0	.0	20.0	2.0	36	4.30	235.0	235.0	9.0	215.0	20.0
964fa	2.0	.0	20.0	6.0	36	5.50	236.0	236.0	11.0	223.0	13.0
964fa	1.0	.0	21.0	2.0		6.0	232.0	232.0	10.0	208.0	24.0
964fa	1.0	.0	21.0	2.0	37	6.0	247.0	247.0	33.0	213.0	34.0
964fa	2.0	.0	21.0	2.0	41	10.0	275.0	275.0	10.0	197.0	78.0
964fa	2.0	.0	21.0	2.0	32	6.0	232.0	232.0	20.0	223.0	9.0
964fa	5.0	.0	21.0	2.0		10.50	251.0	251.0	56.0	228.0	23.0
964fa	4.0	.0	21.0	3.0		10.50	236.0	236.0	30.0	220.0	16.0
964fa	3.0	.0	21.0	4.0	39	10.50	236.0	236.0	4.0	189.0	47.0
964fa	5.0	.0	21.0	3.0	39	8.50	257.0	257.0	28.0	218.0	39.0
964fa	1.0	.0	21.0	2.0		.0	266.0	266.0	1.0	222.0	44.0
964fa	1.0	.0	21.0	2.0	36	6.0	260.0	260.0	18.0	212.0	48.0
964fa	1.0	.0	21.0	2.0		7.0	242.0	242.0	17.0	202.0	40.0
964fa	4.0	.0	21.0	5.0	37	1.50	250.0	250.0	31.0	202.0	48.0
964fa	1.0	.0	21.0	2.0	46	6.0	248.0	248.0	5.0	225.0	23.0
964fa	2.0	.0	21.0	2.0		10.0	253.0	253.0	28.0	216.0	37.0
964fa	4.0	.0	21.0	5.0	37	1.0	241.0	241.0	17.0	223.0	18.0
964fa	3.0	.0	21.0	2.0	35	7.0	234.0	234.0	19.0	214.0	20.0
964fa	1.0	.0	21.0	3.0	37	6.0	237.0	237.0	12.0	227.0	10.0
964fa	1.0	.0	21.0	2.0	33	6.0	253.0	253.0	20.0	213.0	40.0
964fa	2.0	.0	21.0	2.0	33	8.0	242.0	242.0	33.0	209.0	33.0
964fa	4.0	.0	21.0	5.0		2.50	260.0	260.0	49.0	214.0	46.0
964fa	2.0	.0	21.0	3.0		11.50	269.0	269.0	27.0	220.0	49.0
964fa	1.0	.0	21.0	3.0	35	7.0	236.0	236.0	28.0	194.0	42.0
964fa	2.0	.0	21.0	2.0	35	8.0	258.0	258.0	41.0	209.0	49.0
964fa	2.0	.0	21.0	5.0	32	8.0	241.0	241.0	37.0	211.0	30.0
964fa	1.0	.0	21.0	3.0		6.0	248.0	248.0	6.0	203.0	45.0
964fa	2.0	.0	21.0	3.0	33	2.50	240.0	240.0	16.0	169.0	71.0
964fa	2.0	.0	21.0	2.0	33	7.0	242.0	242.0	44.0	202.0	40.0
964fa	1.0	.0	21.0	2.0	45	8.0	281.0	281.0	27.0	218.0	63.0
964fa	1.0	.0	22.0	2.0	36	5.50	259.0	259.0	11.0	204.0	55.0
964fa	3.0	.0	22.0	3.0	40	8.0	240.0	240.0	63.0	207.0	33.0
964fa	1.0	.0	22.0	2.0	40	6.0	232.0	232.0	7.0	212.0	20.0
964fa	2.0	.0	22.0	3.0	39	6.0	242.0	242.0	32.0	197.0	45.0
964fa	1.0	.0	22.0	2.0	36	6.0	232.0	232.0	13.0	227.0	5.0
964fa	2.0	.0	22.0	4.0		7.0	242.0	242.0	23.0	216.0	26.0

Semest	Sems	Sex	Age	# tasp	Asset	Gain dest	Pass tasp	Post O_2	Time	Pre O_1	Diff tasp
964fa	1.0	.0	22.0	2.0	36	3.80	236.0	236.0	23.0	195.0	41.0
964fa	1.0	.0	22.0	2.0		2.0	244.0	244.0	7.0	218.0	26.0
964fa	1.0	.0	22.0	7.0		8.50	242.0	242.0	31.0	179.0	63.0
964fa	3.0	.0	22.0	3.0	36	8.0	237.0	237.0	69.0	214.0	23.0
964fa	2.0	.0	23.0	3.0		10.50	236.0	236.0	44.0	207.0	29.0
964fa	2.0	.0	23.0	3.0		6.0	236.0	236.0	42.0	203.0	33.0
964fa	3.0	.0	23.0	2.0		8.50	258.0	258.0	23.0	187.0	71.0
964fa	1.0	.0	23.0	10.0		2.50	242.0	242.0	19.0	195.0	47.0
964fa	1.0	.0	23.0	3.0		6.0	281.0	281.0	4.0	215.0	66.0
964fa	3.0	.0	23.0	2.0	30	8.50	243.0	243.0	74.0	212.0	31.0
964fa	1.0	.0	23.0	7.0		8.0	275.0	275.0	23.0	218.0	57.0
964fa	2.0	.0	23.0	5.0		7.0	230.0	230.0	52.0	224.0	6.0
964fa	2.0	.0	23.0	2.0	39	7.0	230.0	230.0	19.0	215.0	15.0
964fa	1.0	.0	24.0	4.0	41	7.50	244.0	244.0	5.0	218.0	26.0
964fa	1.0	.0	24.0	3.0		10.50	259.0	259.0	35.0	222.0	37.0
964fa	1.0	.0	24.0	2.0		7.0	253.0	253.0	14.0	204.0	49.0
964fa	2.0	.0	25.0	3.0		6.0	247.0	247.0	19.0	217.0	30.0
964fa	1.0	.0	25.0	2.0		5.0	240.0	240.0	22.0	206.0	34.0
964fa	4.0	.0	28.0	5.0	36	10.0	243.0	243.0	10.0	221.0	22.0
964fa	4.0	.0	29.0	2.0	37	10.50	235.0	235.0	32.0	228.0	7.0
964fa	4.0	.0	29.0	4.0		10.50	231.0	231.0	4.0	215.0	16.0
964fa	1.0	.0	30.0	5.0		.50	243.0	243.0	8.0	200.0	43.0
964fa	1.0	.0	32.0	2.0		9.0	248.0	248.0	11.0	194.0	54.0
964fa	2.0	.0	32.0	3.0		7.0	281.0	281.0	33.0	208.0	73.0
964fa	2.0	.0	34.0	4.0		7.0	264.0	264.0	38.0	161.0	103.0
964fa	4.0	.0	42.0	2.0	33	7.0	236.0	236.0	16.0	212.0	24.0
964fa	4.0	.0	.	5.0		7.50	.	142.0	27.0	158.0	-16.0
964fa	2.0	1.0	19.0	2.0	37	7.0	281.0	281.0	34.0	223.0	58.0
964fa	4.0	1.0	20.0	2.0	40	7.50	244.0	244.0	38.0	207.0	37.0
964fa	1.0	1.0	20.0	2.0	34	2.50	.	223.0	6.0	208.0	15.0
964fa	3.0	1.0	20.0	2.0	32	.0	.	224.0	8.0	210.0	14.0
964fa	1.0	1.0	20.0	5.0	30	4.0	.	212.0	19.0	178.0	34.0
964fa	1.0	1.0	20.0	2.0	36	4.0	.	154.0	12.0	142.0	12.0
964fa	2.0	1.0	20.0	2.0	35	7.0	237.0	237.0	19.0	211.0	26.0
964fa	4.0	1.0	21.0	3.0	34	10.50	.	223.0	4.0	206.0	17.0
964fa	4.0	1.0	21.0	4.0	32	8.50	.	187.0	23.0	203.0	-16.0
964fa	4.0	1.0	21.0	3.0	28	3.90	.	186.0	20.0	145.0	41.0
964fa	2.0	1.0	21.0	4.0	34	7.0	.	199.0	30.0	181.0	18.0
964fa	5.0	1.0	21.0	3.0	35	10.50	.	226.0	30.0	216.0	10.0
964fa	2.0	1.0	21.0	2.0	31	6.0	.	216.0	19.0	203.0	13.0
964fa	1.0	1.0	21.0	2.0	27	3.0	.	161.0	3.0	153.0	8.0

Semest	Sems	Sex	Age	# tasp	Asset	Gain dest	Pass tasp	Post O_2	Time	Pre O_1	Diff tasp
964fa	2.0	1.0	21.0	2.0	33	7.0	.	191.0	38.0	217.0	-26.0
964fa	2.0	1.0	21.0	3.0	31	5.50	261.0	261.0	21.0	216.0	45.0
964fa	1.0	1.0	22.0	4.0	31	10.0	.	209.0	35.0	178.0	31.0
964fa	2.0	1.0	22.0	3.0	33	4.80	.	206.0	52.0	194.0	12.0
964fa	1.0	1.0	22.0	4.0		8.0	.	206.0	51.0	209.0	-3.0
964fa	1.0	1.0	22.0	3.0		6.0	.	214.0	16.0	206.0	8.0
964fa	4.0	1.0	22.0	5.0		3.80	.	218.0	43.0	182.0	36.0
964fa	1.0	1.0	22.0	2.0	35	3.40	.	181.0	22.0	163.0	18.0
964fa	1.0	1.0	22.0	3.0	26	1.50	.	222.0	3.0	163.0	59.0
964fa	2.0	1.0	23.0	2.0		6.0	.	221.0	36.0	202.0	19.0
964fa	3.0	1.0	23.0	2.0		8.0	.	218.0	12.0	214.0	4.0
964fa	2.0	1.0	23.0	3.0		2.0	.	180.0	16.0	158.0	22.0
964fa	4.0	1.0	24.0	2.0	33	4.80	.	201.0	43.0	197.0	4.0
964fa	3.0	1.0	25.0	6.0		2.50	.	215.0	10.0	164.0	51.0
964fa	1.0	1.0	25.0	2.0	36	3.80	.	224.0	7.0	203.0	21.0
964fa	4.0	1.0	20.0	4.0	32	10.50	234.0	234.0	24.0	182.0	52.0
964fa	2.0	1.0	20.0	2.0	40	1.50	251.0	251.0	19.0	221.0	30.0
964fa	1.0	1.0	20.0	3.0		4.80	242.0	242.0	21.0	212.0	30.0
964fa	1.0	1.0	20.0	2.0	34	10.50	242.0	242.0	12.0	163.0	79.0
964fa	1.0	1.0	20.0	2.0		8.0	247.0	247.0	26.0	213.0	34.0
964fa	2.0	1.0	20.0	3.0	35	10.50	258.0	258.0	22.0	224.0	34.0
964fa	1.0	1.0	20.0	2.0		6.0	275.0	275.0	5.0	143.0	132.0
964fa	1.0	1.0	20.0	2.0	39	10.0	232.0	232.0	8.0	214.0	18.0
964fa	1.0	1.0	21.0	2.0	39	4.0	243.0	243.0	11.0	217.0	26.0
964fa	1.0	1.0	21.0	2.0		3.80	236.0	236.0	19.0	198.0	38.0
964fa	1.0	1.0	21.0	4.0	36	5.0	236.0	236.0	25.0	213.0	23.0
964fa	4.0	1.0	21.0	10.0		10.50	232.0	232.0	15.0	228.0	4.0
964fa	1.0	1.0	21.0	3.0	33	5.50	259.0	259.0	16.0	217.0	42.0
964fa	2.0	1.0	21.0	2.0		4.40	242.0	242.0	34.0	218.0	24.0
964fa	1.0	1.0	21.0	2.0	39	7.0	253.0	253.0	20.0	218.0	35.0
964fa	3.0	1.0	21.0	2.0	39	10.50	242.0	242.0	10.0	180.0	62.0
964fa	3.0	1.0	21.0	3.0		6.0	235.0	235.0	35.0	205.0	30.0
964fa	1.0	1.0	21.0	2.0	45	7.0	260.0	260.0	16.0	209.0	51.0
964fa	1.0	1.0	22.0	4.0		1.0	238.0	238.0	3.0	199.0	39.0
964fa	2.0	1.0	22.0	4.0		10.50	251.0	251.0	64.0	218.0	33.0
964fa	1.0	1.0	22.0	2.0	39	10.50	249.0	249.0	7.0	205.0	44.0
964fa	1.0	1.0	22.0	3.0	35	5.50	253.0	253.0	18.0	217.0	36.0
964fa	1.0	1.0	22.0	4.0	39	8.0	250.0	250.0	8.0	217.0	33.0
964fa	1.0	1.0	22.0	2.0	37	7.0	253.0	253.0	11.0	205.0	48.0
964fa	1.0	1.0	22.0	2.0		6.0	245.0	245.0	7.0	161.0	84.0
964fa	1.0	1.0	22.0	2.0	30	3.80	242.0	242.0	24.0	217.0	25.0

Semest	Sems	Sex	Age	# tasp	Asset	Gain dest	Pass tasp	Post O_2	Time	Pre O_1	Diff tasp
964fa	1.0	1.0	22.0	2.0	40	10.50	273.0	273.0	61.0	227.0	46.0
964fa	2.0	1.0	23.0	7.0		5.50	259.0	259.0	18.0	203.0	56.0
964fa	1.0	1.0	23.0	2.0	40	10.0	243.0	243.0	15.0	153.0	90.0
964fa	2.0	1.0	23.0	4.0		6.0	253.0	253.0	30.0	173.0	80.0
964fa	1.0	1.0	23.0	2.0	37	2.50	262.0	262.0	1.0	209.0	53.0
964fa	3.0	1.0	23.0	2.0	34	6.0	245.0	245.0	9.0	194.0	51.0
964fa	1.0	1.0	24.0	2.0	37	2.50	239.0	239.0	1.0	210.0	29.0
964fa	2.0	1.0	25.0	2.0	40	10.50	269.0	269.0	16.0	194.0	75.0
971sp	2.0	.0	18.0	3.0		3.0	266.0	266.0	14.0	215.0	51.0
971sp	2.0	.0	19.0	3.0	37	2.0	.	210.0	13.0	217.0	-7.0
971sp	4.0	.0	19.0	3.0	30	6.0	.	190.0	41.0	141.0	49.0
971sp	2.0	.0	20.0	2.0	31	3.50	.	221.0	28.0	201.0	20.0
971sp	2.0	.0	21.0	3.0	33	5.0	.	214.0	35.0	202.0	12.0
971sp	3.0	.0	21.0	4.0		6.0	250.0	250.0	68.0	200.0	50.0
971sp	3.0	.0	21.0	2.0		3.0	.	192.0	32.0	148.0	44.0
971sp	1.0	.0	21.0	3.0	35	.50	.	217.0	16.0	206.0	11.0
971sp	1.0	.0	21.0	3.0	31	1.0	.	212.0	6.0	206.0	6.0
971sp	3.0	.0	21.0	3.0		8.0	.	200.0	19.0	198.0	2.0
971sp	2.0	.0	21.0	3.0	33	5.50	.	180.0	19.0	177.0	3.0
971sp	4.0	.0	22.0	2.0	31	5.0	.	207.0	15.0	215.0	-8.0
971sp	4.0	.0	22.0	8.0		7.50	.	221.0	16.0	207.0	14.0
971sp	2.0	.0	22.0	5.0		1.0	.	216.0	44.0	213.0	3.0
971sp	3.0	.0	22.0	9.0		10.50	.	220.0	20.0	205.0	15.0
971sp	2.0	.0	23.0	2.0	30	6.50	.	186.0	23.0	191.0	-5.0
971sp	4.0	.0	23.0	6.0	30	10.0	.	215.0	48.0	196.0	19.0
971sp	4.0	.0	24.0	7.0		10.50	.	191.0	7.0	169.0	22.0
971sp	3.0	.0	24.0	3.0	39	4.50	239.0	239.0	30.0	226.0	13.0
971sp	1.0	.0	26.0	4.0		3.0	.	120.0	16.0	130.0	-10.0
971sp	3.0	.0	27.0	3.0	37	3.50	.	215.0	30.0	226.0	-11.0
971sp	4.0	.0	27.0	3.0	41	10.50	244.0	244.0	31.0	159.0	85.0
971sp	4.0	.0	28.°	4.0		10.50	.	203.0	45.0	175.0	28.0
971sp	1.0	.0	28.0	3.0	34	4.50	.	197.0	16.0	179.0	18.0
971sp	2.0	.0	30.0	2.0		8.0	.	209.0	15.0	204.0	5.0
971sp	3.0	.0	38.0	2.0	30	7.50	.	166.0	47.0	178.0	-12.0
971sp	1.0	.0	43.0	6.0		.50	231.0	231.0	15.0	189.0	42.0
971sp	1.0	.0	53.0	4.0		4.80	.	204.0	77.0	180.0	24.0
971sp	3.0	.0	19.0	3.0	39	2.0	247.0	247.0	38.0	212.0	35.0
971sp	2.0	.0	19.0	2.0	40	3.0	238.0	238.0	13.0	220.0	18.0
971sp	3.0	.0	19.0	3.0	34	7.50	245.0	245.0	18.0	204.0	41.0
971sp	1.0	.0	19.0	2.0	45	1.50	264.0	264.0	22.0	182.0	82.0
971sp	1.0	.0	20.0	3.0	34	2.0	240.0	240.0	21.0	206.0	34.0

Semest	Sems	Sex	Age	# tasp	Asset	Gain dest	Pass tasp	Post O_2	Time	Pre O_1	Diff tasp
971sp	2.0	.0	20.0	2.0	31	3.0	245.0	245.0	34.0	205.0	40.0
971sp	1.0	.0	20.0	2.0		2.0	236.0	236.0	22.0	200.0	36.0
971sp	2.0	.0	20.0	2.0		.50	269.0	269.0	3.0	210.0	59.0
971sp	1.0	.0	20.0	2.0	40	1.0	246.0	246.0	21.0	206.0	40.0
971sp	2.0	.0	20.0	3.0		3.0	249.0	249.0	37.0	192.0	57.0
971sp	3.0	.0	20.0	6.0	28	1.0	232.0	232.0	10.0	222.0	10.0
971sp	4.0	.0	21.0	2.0		7.50	265.0	265.0	82.0	205.0	60.0
971sp	1.0	.0	21.0	4.0	35	3.50	253.0	253.0	24.0	222.0	31.0
971sp	2.0	.0	21.0	2.0	41	4.0	236.0	236.0	35.0	211.0	25.0
971sp	3.0	.0	21.0	2.0	41	5.0	236.0	236.0	4.0	211.0	25.0
971sp	1.0	.0	21.0	4.0		3.50	254.0	254.0	18.0	191.0	63.0
971sp	1.0	.0	21.0	2.0	43	10.50	239.0	239.0	18.0	214.0	25.0
971sp	2.0	.0	22.0	3.0		3.0	242.0	242.0	36.0	202.0	40.0
971sp	2.0	.0	22.0	4.0	34	3.0	260.0	260.0	23.0	216.0	44.0
971sp	1.0	.0	22.0	2.0	36	.80	253.0	253.0	7.0	212.0	41.0
971sp	1.0	.0	22.0	2.0		1.50	232.0	232.0	26.0	218.0	14.0
971sp	1.0	.0	22.0	3.0		2.0	236.0	236.0	20.0	183.0	53.0
971sp	4.0	.0	22.0	3.0		4.30	269.0	269.0	23.0	225.0	44.0
971sp	1.0	.0	22.0	2.0		2.0	260.0	260.0	31.0	214.0	46.0
971sp	1.0	.0	23.0	4.0	36	3.0	236.0	236.0	19.0	212.0	24.0
971sp	1.0	.0	23.0	7.0		.40	245.0	236.0	12.0	227.0	9.0
971sp	2.0	.0	23.0	2.0		10.50	232.0	232.0	30.0	171.0	61.0
971sp	2.0	.0	24.0	3.0		1.50	260.0	260.0	11.0	190.0	70.0
971sp	1.0	.0	24.0	10.0		2.50	230.0	230.0	23.0	181.0	49.0
971sp	3.0	.0	25.0	2.0		2.0	258.0	258.0	21.0	226.0	32.0
971sp	3.0	.0	26.0	4.0	35	7.50	239.0	239.0	96.0	194.0	45.0
971sp	3.0	.0	30.0	7.0		5.0	232.0	232.0	29.0	196.0	36.0
971sp	2.0	.0	30.0	2.0	39	1.50	246.0	246.0	30.0	212.0	34.0
971sp	3.0	.0	35.0	2.0	28	5.50	251.0	251.0	32.0	200.0	51.0
971sp	1.0	.0	42.0	6.0		3.0	230.0	230.0	20.0	206.0	24.0
971sp	3.0	1.0	19.0	2.0	36	7.50	256.0	256.0	3.0	197.0	59.0
971sp	3.0	1.0	19.0	4.0	41	2.0	.	226.0	14.0	221.0	5.0
971sp	3.0	1.0	20.0	2.0	39	10.0	.	169.0	56.0	223.0	-54.0
971sp	3.0	1.0	20.0	2.0	31	10.0	.	223.0	46.0	211.0	12.0
971sp	3.0	1.0	21.0	4.0		2.50	236.0	236.0	42.0	201.0	35.0
971sp	5.0	1.0	22.0	3.0	46	7.50	.	217.0	50.0	210.0	7.0
971sp	1.0	1.0	22.0	2.0		.0	.	217.0	11.0	197.0	20.0
971sp	2.0	1.0	23.0	2.0		4.50	.	214.0	21.0	223.0	-9.0
971sp	3.0	1.0	23.0	2.0	29	2.0	233.0	233.0	39.0	159.0	74.0
971sp	1.0	1.0	24.0	5.0		2.0	.	194.0	14.0	188.0	6.0
971sp	4.0	1.0	25.0	3.0		10.50	.	186.0	68.0	180.0	6.0

Semest	Sems	Sex	Age	# tasp	Asset	Gain dest	Pass tasp	Post O_2	Time	Pre O_1	Diff tasp
971sp	3.0	1.0	25.0	2.0	40	3.0	.	216.0	20.0	211.0	5.0
971sp	3.0	1.0	26.0	2.0	30	7.50	.	209.0	55.0	162.0	47.0
971sp	3.0	1.0	32.0	2.0	37	4.0	233.0	233.0	36.0	216.0	17.0
971sp	4.0	1.0	39.0	2.0		8.50	.	209.0	69.0	167.0	42.0
971sp	1.0	1.0	19.0	2.0	34	2.20	231.0	231.0	23.0	211.0	20.0
971sp	1.0	1.0	20.0	3.0	40	2.0	253.0	253.0	43.0	197.0	56.0
971sp	1.0	1.0	20.0	2.0	37	.0	241.0	241.0	6.0	225.0	16.0
971sp	1.0	1.0	20.0	2.0	45	.0	270.0	270.0	4.0	216.0	54.0
971sp	1.0	1.0	20.0	2.0		2.50	264.0	264.0	21.0	223.0	41.0
971sp	1.0	1.0	20.0	3.0	32	3.0	243.0	243.0	18.0	190.0	53.0
971sp	1.0	1.0	20.0	2.0		3.0	253.0	253.0	16.0	217.0	36.0
971sp	1.0	1.0	21.0	3.0	34	7.50	230.0	230.0	26.0	196.0	34.0
971sp	1.0	1.0	21.0	2.0	32	2.0	247.0	247.0	18.0	216.0	31.0
971sp	2.0	1.0	21.0	2.0	36	3.0	260.0	260.0	27.0	216.0	44.0
971sp	3.0	1.0	21.0	2.0	40	1.50	234.0	234.0	31.0	220.0	14.0
971sp	1.0	1.0	21.0	3.0	29	1.80	253.0	253.0	20.0	152.0	101.0
971sp	3.0	1.0	21.0	4.0	32	7.50	231.0	231.0	34.0	206.0	25.0
971sp	2.0	1.0	22.0	5.0	32	4.0	239.0	239.0	15.0	179.0	60.0
971sp	2.0	1.0	22.0	2.0	41	2.0	245.0	245.0	10.0	215.0	30.0
971sp	2.0	1.0	22.0	4.0	31	1.0	247.0	247.0	17.0	218.0	29.0
971sp	1.0	1.0	22.0	4.0	36	2.90	253.0	253.0	13.0	194.0	59.0
971sp	3.0	1.0	22.0	2.0	43	2.50	272.0	272.0	42.0	227.0	45.0
971sp	5.0	1.0	23.0	3.0	28	10.50	248.0	248.0	39.0	200.0	48.0
971sp	1.0	1.0	23.0	2.0	32	1.0	266.0	266.0	20.0	211.0	55.0
971sp	3.0	1.0	23.0	2.0	33	4.0	236.0	236.0	21.0	207.0	29.0
971sp	1.0	1.0	24.0	2.0		6.0	265.0	265.0	16.0	214.0	51.0
971sp	1.0	1.0	25.0	2.0	37	3.0	254.0	254.0	23.0	204.0	50.0
971sp	3.0	1.0	25.0	2.0	39	4.50	233.0	233.0	80.0	218.0	15.0
971sp	1.0	1.0	29.0	2.0		.50	236.0	236.0	4.0	218.0	18.0
971sp	2.0	1.0	33.0	2.0		7.0	277.0	277.0	12.0	254.0	23.0
972su1	2.0	.0	19.0	3.0	43	3.50	242.0	242.0	24.0	209.0	33.0
972su1	1.0	.0	20.0	3.0	33	2.20	237.0	237.0	36.0	216.0	21.0
972su1	2.0	.0	24.0	3.0		7.0	.	224.0	18.0	207.0	17.0
972su1	1.0	.0	25.0	3.0	33	6.50	.	215.0	40.0	197.0	18.0
972su1	2.0	1.0	21.0	3.0	28	.50	.	225.0	15.0	182.0	43.0
972su1	1.0	1.0	19.0	3.0		1.50	271.0	271.0	18.0	216.0	55.0
972su1	3.0	1.0	20.0	3.0	30	5.50	251.0	251.0	31.0	223.0	28.0
972su1	1.0	1.0	20.0	2.0	41	.50	238.0	238.0	13.0	184.0	54.0
973su2	1.0	.0	21.0	2.0	35	5.50	.	180.0	17.0	179.0	1.0
973su2	2.0	.0	23.0	2.0	35	2.0	.	196.0	16.0	183.0	13.0
973su2	3.0	.0	39.0	2.0	31	9.0	.	166.0	27.0	201.0	-35.0

Semest	Sems	Sex	Age	# tasp	Asset	Gain dest	Pass tasp	Post O_2	Time	Pre O_1	Diff tasp
973su2	2.0	.0	19.0	2.0	40	5.50	248.0	248.0	48.0	221.0	27.0
973su2	2.0	.0	22.0	3.0		1.50	242.0	242.0	30.0	228.0	14.0
973su2	1.0	.0	23.0	3.0	26	2.0	231.0	231.0	20.0	198.0	33.0
973su2	1.0	.0	29.0	3.0	32	3.0	230.0	230.0	6.0	195.0	35.0
973su2	4.0	.0	44.0	3.0		7.50	231.0	231.0	35.0	226.0	5.0
973su2	2.0	1.0	21.0	4.0		2.0	250.0	250.0	17.0	197.0	53.0
973su2	1.0	1.0	19.0	2.0	40	1.0	236.0	236.0	18.0	210.0	26.0
973su2	1.0	1.0	23.0	2.0		1.0	231.0	231.0	9.0	184.0	47.0
974fa	1.0	.0	18.0	2.0	35	2.0	.	164.0	14.0	162.0	2.0
974fa	2.0	.0	18.0	2.0	35	1.0	.	207.0	4.0	191.0	16.0
974fa	2.0	.0	18.0	2.0	39	4.50	.	220.0	27.0	200.0	20.0
974fa	1.0	.0	18.0	2.0	37	2.50	258.0	258.0	14.0	212.0	46.0
974fa	1.0	.0	18.0	2.0	37	1.50	238.0	238.0	18.0	212.0	26.0
974fa	2.0	.0	19.0	2.0	32	1.0	.	220.0	18.0	216.0	4.0
974fa	2.0	.0	19.0	3.0	35	2.50	.	217.0	10.0	147.0	70.0
974fa	1.0	.0	19.0	2.0	33	2.50	233.0	233.0	41.0	207.0	26.0
974fa	2.0	.0	19.0	3.0	34	4.50	.	210.0	20.0	212.0	-2.0
974fa	2.0	.0	19.0	2.0	32	4.60	.	205.0	30.0	180.0	25.0
974fa	2.0	.0	20.0	9.0	35	4.50	.	214.0	17.0	187.0	27.0
974fa	2.0	.0	20.0	2.0	39	2.10	.	207.0	13.0	212.0	-5.0
974fa	2.0	.0	20.0	4.0	33	1.50	.	202.0	21.0	164.0	38.0
974fa	1.0	.0	20.0	3.0		3.50	.	224.0	12.0	216.0	8.0
974fa	2.0	.0	20.0	5.0	37	4.50	244.0	244.0	34.0	218.0	26.0
974fa	2.0	.0	20.0	2.0	33	4.50	.	185.0	37.0	178.0	7.0
974fa	2.0	.0	20.0	2.0	35	1.0	.	218.0	9.0	197.0	21.0
974fa	2.0	.0	20.0	2.0	33	3.0	.	207.0	24.0	181.0	26.0
974fa	2.0	.0	20.0	2.0		2.0	.	218.0	13.0	210.0	8.0
974fa	2.0	.0	21.0	4.0	36	7.10	.	226.0	10.0	212.0	14.0
974fa	2.0	.0	21.0	2.0		1.0	.	206.0	13.0	180.0	26.0
974fa	2.0	.0	21.0	3.0	40	4.50	.	181.0	29.0	188.0	-7.0
974fa	1.0	.0	21.0	2.0	36	2.0	.	223.0	15.0	210.0	13.0
974fa	2.0	.0	21.0	5.0	31	6.50	.	218.0	51.0	205.0	13.0
974fa	2.0	.0	22.0	3.0	28	9.50	.	186.0	28.0	143.0	43.0
974fa	2.0	.0	23.0	2.0	36	3.70	.	221.0	47.0	223.0	-2.0
974fa	2.0	.0	23.0	3.0	39	3.50	.	186.0	38.0	173.0	13.0
974fa	3.0	.0	24.0	3.0		5.50	.	218.0	7.0	194.0	24.0
974fa	2.0	.0	25.0	3.0	31	2.0	.	187.0	32.0	175.0	12.0
974fa	3.0	.0	25.0	4.0		10.50	.	212.0	23.0	223.0	-11.0
974fa	1.0	.0	25.0	4.0		5.0	255.0	255.0	15.0	201.0	54.0
974fa	3.0	.0	31.0	4.0	36	10.50	.	225.0	23.0	209.0	16.0
974fa	2.0	.0	37.0	2.0	34	4.10	.	197.0	30.0	200.0	-3.0

Semest	Sems	Sex	Age	# tasp	Asset	Gain dest	Pass tasp	Post O_2	Time	Pre O_1	Diff tasp
974fa	2.0	.0	39.0	3.0	33	4.0	.	196.0	14.0	166.0	30.0
974fa	2.0	.0	40.0	2.0	32	6.50	244.0	244.0	74.0	197.0	47.0
974fa	2.0	.0	43.0	3.0	32	7.10	.	212.0	38.0	191.0	21.0
974fa	2.0	.0	50.0	2.0	33	5.0	244.0	244.0	98.0	191.0	53.0
974fa	2.0	.0	18.0	2.0	31	7.0	250.0	250.0	66.0	226.0	24.0
974fa	2.0	.0	18.0	5.0	26	3.0	248.0	248.0	40.0	228.0	20.0
974fa	2.0	.0	19.0	3.0	37	1.0	235.0	235.0	37.0	217.0	18.0
974fa	1.0	.0	19.0	3.0	39	1.50	238.0	238.0	21.0	224.0	14.0
974fa	2.0	.0	19.0	3.0	36	2.50	234.0	234.0	30.0	217.0	17.0
974fa	1.0	.0	19.0	2.0		3.0	238.0	238.0	20.0	183.0	55.0
974fa	2.0	.0	19.0	3.0	28	7.0	238.0	238.0	47.0	195.0	43.0
974fa	1.0	.0	19.0	2.0		3.0	277.0	277.0	10.0	197.0	80.0
974fa	1.0	.0	19.0	3.0	37	1.0	236.0	236.0	13.0	217.0	19.0
974fa	1.0	.0	19.0	2.0	35	7.0	245.0	245.0	39.0	212.0	33.0
974fa	1.0	.0	19.0	2.0	41	1.0	231.0	231.0	11.0	215.0	16.0
974fa	1.0	.0	19.0	2.0	45	.50	248.0	248.0	9.0	220.0	28.0
974fa	2.0	.0	19.0	3.0	37	3.0	240.0	240.0	49.0	216.0	24.0
974fa	1.0	.0	19.0	3.0	34	4.0	260.0	260.0	20.0	204.0	56.0
974fa	1.0	.0	19.0	2.0	43	1.0	242.0	242.0	12.0	220.0	22.0
974fa	1.0	.0	19.0	3.0	31	1.0	230.0	230.0	7.0	211.0	19.0
974fa	2.0	.0	19.0	3.0		2.0	247.0	247.0	14.0	197.0	50.0
974fa	1.0	.0	19.0	2.0	40	1.50	232.0	232.0	21.0	187.0	45.0
974fa	1.0	.0	19.0	2.0	41	4.0	256.0	243.0	20.0	215.0	28.0
974fa	2.0	.0	20.0	2.0	37	2.0	234.0	234.0	52.0	201.0	33.0
974fa	2.0	.0	20.0	3.0	40	3.0	240.0	240.0	34.0	218.0	22.0
974fa	1.0	.0	20.0	2.0		.50	230.0	230.0	12.0	210.0	20.0
974fa	2.0	.0	20.0	3.0	32	1.50	234.0	234.0	44.0	206.0	28.0
974fa	2.0	.0	20.0	2.0	43	10.0	258.0	258.0	3.0	216.0	42.0
974fa	1.0	.0	20.0	3.0	30	2.50	248.0	248.0	15.0	215.0	33.0
974fa	2.0	.0	20.0	2.0	35	4.0	245.0	245.0	12.0	218.0	27.0
974fa	2.0	.0	20.0	6.0	40	2.0	245.0	245.0	30.0	223.0	22.0
974fa	1.0	.0	21.0	2.0	37	.50	253.0	253.0	11.0	228.0	25.0
974fa	2.0	.0	21.0	2.0	33	4.0	242.0	242.0	48.0	200.0	42.0
974fa	1.0	.0	23.0	2.0		1.0	247.0	247.0	7.0	199.0	48.0
974fa	1.0	.0	27.0	3.0	37	3.0	238.0	238.0	21.0	217.0	21.0
974fa	2.0	.0	27.0	5.0	28	2.90	243.0	243.0	13.0	211.0	32.0
974fa	2.0	.0	28.0	2.0		2.50	245.0	245.0	20.0	155.0	90.0
974fa	3.0	.0	28.0	7.0		10.50	237.0	237.0	67.0	191.0	46.0
974fa	2.0	.0	32.0	4.0	30	1.50	241.0	241.0	36.0	175.0	66.0
974fa	1.0	.0	36.0	2.0	41	3.0	267.0	267.0	11.0	212.0	55.0
974fa	2.0	.0	43.0	2.0		8.50	236.0	236.0	58.0	223.0	13.0

Semest	Sems	Sex	Age	# tasp	Asset	Gain dest	Pass tasp	Post O_2	Time	Pre O_1	Diff tasp
974fa	2.0	1.0	18.0	2.0	31	6.0	.	175.0	34.0	190.0	-15.0
974fa	2.0	1.0	18.0	2.0	31	6.0	.	196.0	16.0	146.0	50.0
974fa	1.0	1.0	18.0	2.0	27	1.80	233.0	233.0	14.0	190.0	43.0
974fa	2.0	1.0	19.0	3.0	32	5.0	255.0	255.0	60.0	220.0	35.0
974fa	2.0	1.0	19.0	3.0	37	4.50	.	205.0	25.0	192.0	13.0
974fa	1.0	1.0	19.0	2.0	37	4.50	239.0	239.0	12.0	226.0	13.0
974fa	2.0	1.0	19.0	4.0	37	6.10	.	218.0	13.0	206.0	12.0
974fa	2.0	1.0	19.0	3.0	32	5.70	.	181.0	71.0	216.0	-35.0
974fa	2.0	1.0	19.0	2.0		4.50	.	221.0	23.0	197.0	24.0
974fa	1.0	1.0	19.0	2.0	45	.0	268.0	268.0	7.0	206.0	62.0
974fa	1.0	1.0	19.0	2.0	39	.0	233.0	233.0	3.0	191.0	42.0
974fa	2.0	1.0	20.0	4.0	37	6.50	256.0	256.0	30.0	210.0	46.0
974fa	2.0	1.0	20.0	4.0	39	6.70	.	202.0	67.0	190.0	12.0
974fa	2.0	1.0	20.0	2.0	29	3.0	.	205.0	15.0	191.0	14.0
974fa	2.0	1.0	21.0	2.0	36	2.0	.	215.0	30.0	188.0	27.0
974fa	4.0	1.0	21.0	2.0	34	7.0	.	200.0	23.0	222.0	-22.0
974fa	1.0	1.0	21.0	2.0	32	2.0	.	206.0	22.0	172.0	34.0
974fa	1.0	1.0	21.0	2.0	31	1.50	.	199.0	11.0	183.0	16.0
974fa	3.0	1.0	26.0	4.0		6.10	.	197.0	23.0	176.0	21.0
974fa	2.0	1.0	19.0	3.0	35	9.0	238.0	238.0	133.0	226.0	12.0
974fa	2.0	1.0	19.0	2.0	40	2.50	241.0	241.0	18.0	202.0	39.0
974fa	2.0	1.0	19.0	3.0	36	3.50	249.0	249.0	26.0	212.0	37.0
974fa	1.0	1.0	19.0	3.0	39	.50	277.0	277.0	4.0	185.0	92.0
974fa	1.0	1.0	19.0	2.0	40	2.0	234.0	234.0	16.0	188.0	46.0
974fa	2.0	1.0	19.0	3.0	35	2.50	245.0	245.0	31.0	218.0	27.0
974fa	1.0	1.0	19.0	3.0	41	1.0	232.0	232.0	15.0	151.0	81.0
974fa	2.0	1.0	19.0	4.0	35	2.50	257.0	257.0	26.0	212.0	45.0
974fa	2.0	1.0	19.0	2.0	37	4.50	251.0	251.0	30.0	200.0	51.0
974fa	2.0	1.0	19.0	2.0	35	2.0	245.0	245.0	46.0	206.0	39.0
974fa	1.0	1.0	20.0	4.0	39	2.0	243.0	243.0	23.0	206.0	37.0
974fa	1.0	1.0	20.0	2.0	41	.50	248.0	248.0	2.0	207.0	41.0
974fa	2.0	1.0	20.0	2.0	31	4.0	240.0	240.0	35.0	215.0	25.0
974fa	1.0	1.0	20.0	2.0	34	1.0	242.0	242.0	17.0	201.0	41.0
974fa	1.0	1.0	21.0	2.0	41	1.0	253.0	253.0	15.0	206.0	47.0
974fa	1.0	1.0	21.0	4.0		1.80	246.0	246.0	14.0	205.0	41.0
974fa	1.0	1.0	21.0	2.0	37	4.50	249.0	249.0	14.0	216.0	33.0
974fa	1.0	1.0	22.0	2.0	45	5.50	247.0	247.0	18.0	209.0	38.0
974fa	1.0	1.0	23.0	2.0		1.0	281.0	281.0	14.0	218.0	63.0
974fa	2.0	1.0	25.0	2.0		2.60	247.0	247.0	33.0	207.0	40.0
974fa	2.0	1.0	26.0	2.0		2.50	264.0	264.0	34.0	171.0	93.0
974fa	1.0	1.0	27.0	2.0		1.0	264.0	264.0	17.0	218.0	46.0

Semest	Sems	Sex	Age	# tasp	Asset	Gain dest	Pass tasp	Post O_2	Time	Pre O_1	Diff tasp
981sp	1.0	.0	18.0	2.0	36	1.0	.	199.0	36.0	196.0	3.0
981sp	1.0	.0	18.0	2.0	40	1.0	270.0	270.0	32.0	216.0	54.0
981sp	1.0	.0	19.0	3.0	37	6.50	263.0	263.0	65.0	202.0	61.0
981sp	1.0	.0	19.0	2.0	34	2.0	.	228.0	30.0	146.0	82.0
981sp	1.0	.0	19.0	3.0	32	3.50	237.0	237.0	38.0	187.0	50.0
981sp	1.0	.0	19.0	2.0	40	1.50	.	228.0	35.0	221.0	7.0
981sp	1.0	.0	20.0	2.0	30	.50	.	210.0	30.0	222.0	-12.0
981sp	1.0	.0	21.0	2.0	37	3.60	.	228.0	30.0	169.0	59.0
981sp	2.0	.0	22.0	3.0	35	5.50	233.0	233.0	36.0	183.0	50.0
981sp	1.0	.0	23.0	3.0	29	3.0	.	186.0	27.0	218.0	-32.0
981sp	1.0	.0	28.0	2.0	39	2.60	.	228.0	30.0	218.0	10.0
981sp	1.0	.0	44.0	2.0	35	5.70	.	205.0	37.0	206.0	-1.0
981sp	1.0	.0	19.0	2.0	41	3.0	269.0	269.0	30.0	215.0	54.0
981sp	1.0	.0	19.0	2.0	35	3.0	238.0	238.0	30.0	217.0	21.0
981sp	1.0	.0	19.0	2.0	37	2.50	253.0	253.0	18.0	216.0	37.0
981sp	1.0	.0	19.0	3.0	37	3.0	262.0	262.0	35.0	215.0	47.0
981sp	1.0	.0	19.0	3.0	34	6.50	254.0	254.0	30.0	216.0	38.0
981sp	1.0	.0	19.0	2.0	35	3.0	237.0	237.0	49.0	192.0	45.0
981sp	1.0	.0	19.0	3.0	41	1.80	242.0	242.0	24.0	224.0	18.0
981sp	1.0	.0	20.0	4.0	34	2.60	247.0	247.0	34.0	196.0	51.0
981sp	1.0	.0	20.0	3.0	37	10.0	261.0	261.0	91.0	170.0	91.0
981sp	1.0	.0	20.0	2.0		1.0	279.0	279.0	32.0	191.0	88.0
981sp	1.0	.0	20.0	2.0	36	3.0	244.0	244.0	34.0	200.0	44.0
981sp	1.0	.0	22.0	2.0		3.0	239.0	239.0	30.0	215.0	24.0
981sp	1.0	.0	23.0	2.0		.50	245.0	245.0	32.0	178.0	67.0
981sp	1.0	.0	24.0	2.0	35	2.0	250.0	250.0	57.0	228.0	22.0
981sp	1.0	.0	26.0	3.0		3.0	237.0	237.0	35.0	200.0	37.0
981sp	1.0	.0	28.0	2.0	41	5.0	237.0	237.0	51.0	164.0	73.0
981sp	2.0	.0	30.0	2.0	35	.50	257.0	257.0	16.0	195.0	62.0
981sp	1.0	.0	35.0	2.0	31	3.50	253.0	253.0	24.0	207.0	46.0
981sp	1.0	1.0	19.0	4.0	30	5.50	.	194.0	66.0	218.0	-24.0
981sp	2.0	1.0	19.0	3.0		5.50	.	221.0	31.0	192.0	29.0
981sp	1.0	1.0	27.0	2.0		2.50	.	216.0	19.0	217.0	-1.0
981sp	1.0	1.0	35.0	2.0	27	2.0	.	187.0	67.0	187.0	.0
981sp	1.0	1.0	19.0	3.0	41	.0	253.0	253.0	30.0	212.0	41.0
981sp	1.0	1.0	21.0	2.0	29	3.90	240.0	240.0	43.0	216.0	24.0
982s1	1.0	.0	.	2.0		3.0	248.0	248.0	12.0	228.0	20.0
982s1	1.0	.0	.	2.0		3.0	.	210.0	34.0	163.0	47.0
982s1	3.0	.0	.	2.0		5.50	.	212.0	38.0	212.0	.0
982s1	2.0	1.0	.	2.0		2.0	.	210.0	46.0	175.0	35.0

APPENDIX C

REGRESSION LINE FOR THE VARIABLES: TASP-DIFFERENCE

AND TIME-ON-TASK FOR

ALL STUDENTS

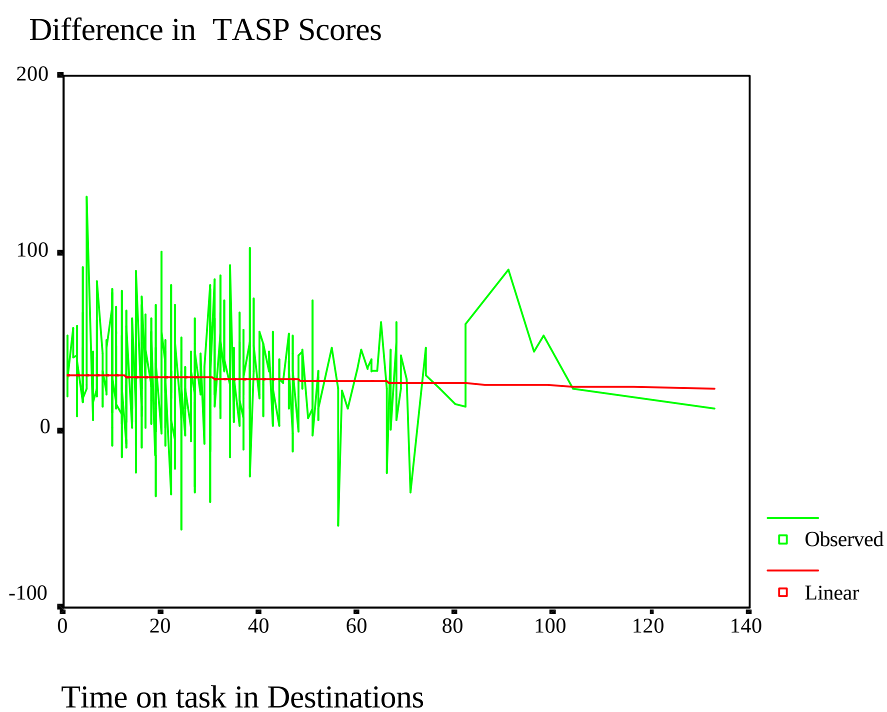

Figure 2. Regression line for the variables: TASP-difference and time-on-task for all students. The regression line has a slight negative slope. N = 482.

APPENDIX D

REGRESSION LINES FOR THE VARIABLES: TASP-DIFFERENCE

AND TIME-ON-TASK FOR ALL FEMALES

AND ALL MALES

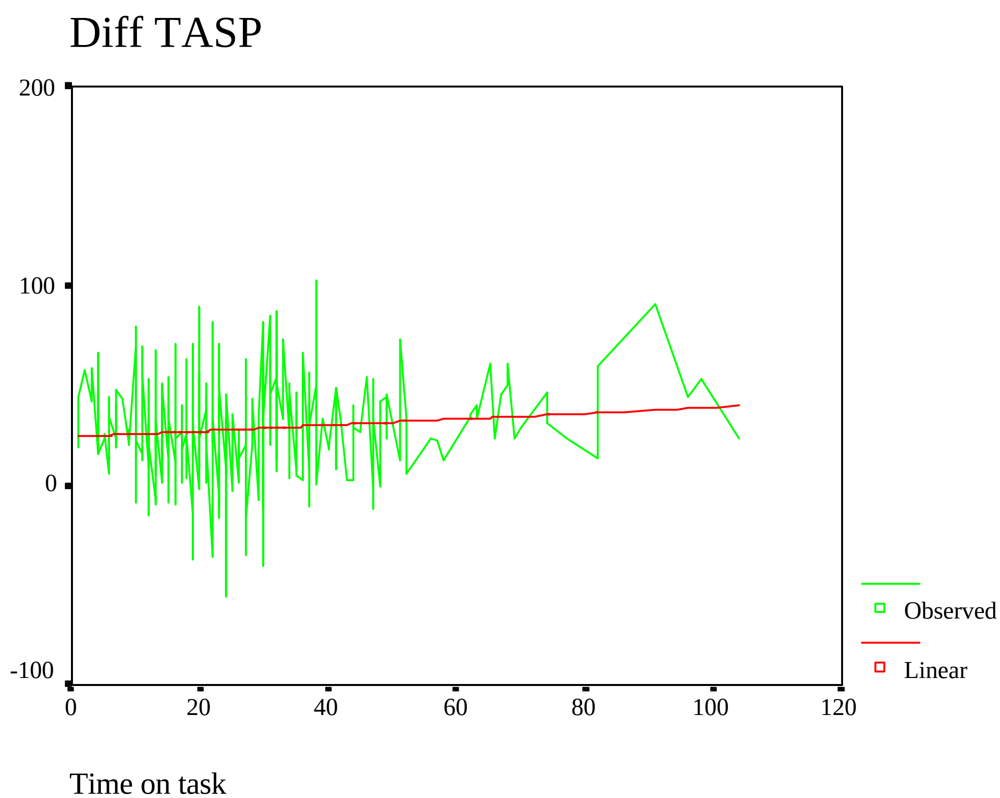

Figure 3. Regression line for the variable: TASP-difference and time-on-task for all females. The regression line for all females has a small positive slope. N = 315.

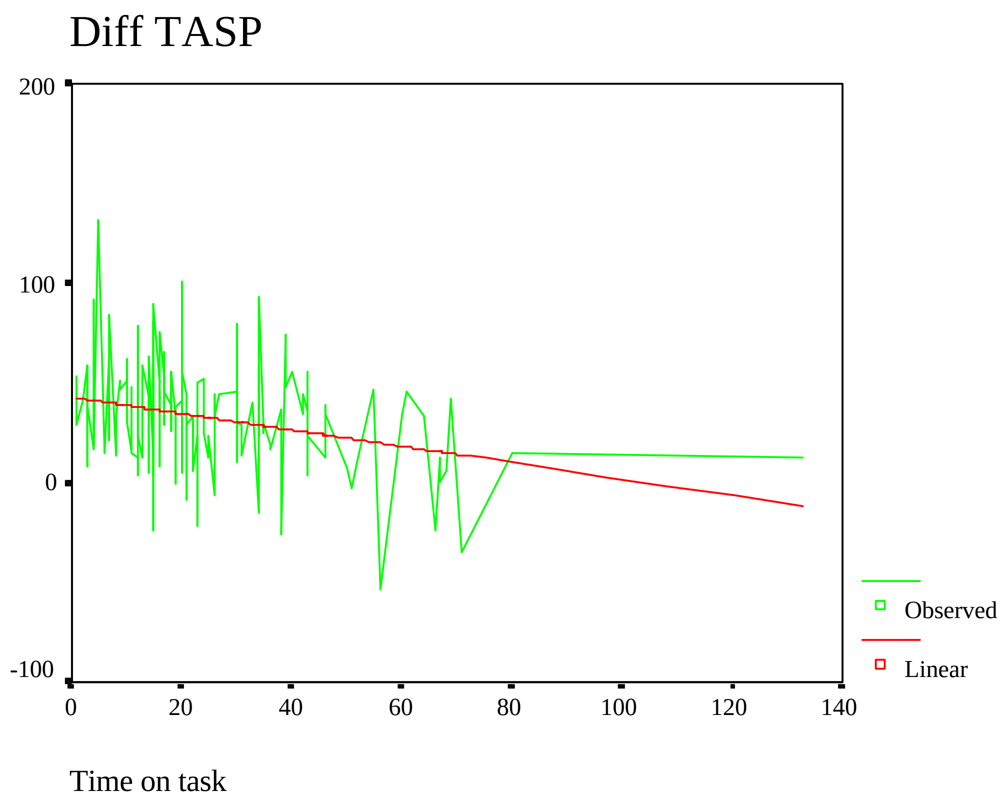

Figure 4. Regression line for the variables: TASP-difference and time-on-task for all males. The regression line has a significant negative slope. N = 167.

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